



*Driving Africa's agricultural development
by **enabling biosciences innovations***

hub.africabiosciences.org

The BeCA-ILRI Hub Annual Report **2016**

Mobilizing biosciences in and for Africa's agricultural development



The BecA-ILRI Hub has continued to strengthen the capacity of african scientists to address key agricultural development challenges, including increased productivity, food safety and climate change adaptation and mitigation.

Driving Africa's agricultural development by **enabling biosciences innovations**

The BecA-ILRI Hub Annual Report **2016**
Mobilizing biosciences in and for Africa's agricultural development

Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub
PO Box 30709 Nairobi 00100 Kenya | Tel: +254 20 422 3805
BecA-Hub@cgiar.org | hub.africabiosciences.org



hub.africabiosciences.org



The Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub is a co-creation of the African Union's New Partnership for Africa's Development (AU/NEPAD) and the International Livestock Research Institute (ILRI).

The BecA-ILRI Hub's

VISION

is to contribute towards improving the livelihoods of millions of resource-poor people in Africa using biosciences-based technologies that improve agricultural productivity, increase incomes and improve food and nutritional security.



The BecA-ILRI Hub's

MISSION

is to mobilize bioscience for Africa's development by providing a centre for excellence in agricultural biosciences, which enables research, capacity building and product incubation, conducted by scientists in Africa and for Africa, and empowers African institutions to harness innovations for regional impact.

Contents

IN THIS EDITION, YOU WILL READ ABOUT

Fifteen years as a regional centre for excellence, strengthening the capacity of African national researchers and institutions in agricultural bioscience for development impact;

Research led by national programs that is influencing agricultural policy development in food security and livestock health;

Strategic partnerships that facilitate technology transfer and bring international research capabilities to bear on African agricultural challenges;

Progress in mobilizing regional researchers and institutions to pool resources and jointly tackle agricultural issues of continental importance;

Engagement with the advisory panel and donors to support, sustainability and strategic relevance within the region; and

A summary of the BecA-ILRI Hub's human and financial resources.

Foreword	2
BecA-ILRI Hub celebrates 15 years as a regional centre for excellence in agricultural biosciences	4
Supporting African-led agricultural research to drive economic growth	6
Bioscience training: accelerating research, strengthening science leadership and shaping Africa's agriculture policy	14
Advancing cutting-edge research in Africa	24
Engaging with collaborators, investors and an advisory panel	32
Pooling capacities for increased impact	36
Raising the profile of the bioscience research centre for excellence	40
Capacity to support research in Africa	44
Staff in 2016	46
Research fellows	47
Scientific publications	50
Statement of income and expenses	54
List of acronyms	56

In 2016, the Biosciences eastern and central Africa–International Livestock Research Institute (Beca-ILRI) Hub celebrated 15 years as a centre for excellence for agricultural research. Against a backdrop of renewed impetus for innovation in agricultural research for development (AR4D) in Africa, Beca-ILRI Hub and its partners showcased their joint achievements in responding to the Science Agenda for Agriculture in Africa (S3A)—leveraging science in an agriculture-led social and economic transformation. The event also offered us an opportunity to acknowledge our donors, whose support has made these accomplishments possible.

Research facilitated by the Beca-ILRI Hub drives the bioscience innovations that underpin development outcomes. The success of the climate-smart Brachiaria program in developing technologies that are readily adapted by farmers has generated a demand for their scaling-up. Strategic partnerships, for instance with the North Carolina State University (NCSU)—leveraging the human resource of advanced research institutions—have enabled ground-breaking work in tackling the devastating cassava mosaic disease, potentially increasing yields in what is a staple crop for over 250 million people in Africa.

Through the Africa Biosciences Challenge Fund (ABCF) fellowship program, up and coming research fellows from national agricultural research systems (NARS) have contributed to the formulation of evidence-based agricultural policies. For instance, seminal work on maize and food safety has provided a clearer picture of the interventions required throughout the value chain in Rwanda and research into chicken vaccines has supported the elaboration of policies guiding the production of vaccines for infectious bursal disease in Kenya. Moreover, the establishment and support of communities of practice (CoPs) for ABCF alumni has enabled the development of a comprehensive regional approach to the tackling of key livestock and crop research challenges.

In step with technology advances, the Beca-ILRI Hub launched the Integrated Genotyping Service and Support (IGSS) platform to enhance efficiency and precision in plant and livestock breeding, as well as quality seeds assessment. In research led by the International Maize and Wheat Improvement Center (CIMMYT), application of this new technology has improved understanding of the genetic basis for resistance to maize lethal necrosis (MLN). The ongoing upgrading of the Beca-ILRI Hub's technology

Morris Juma, a research fellow from the Ministry of Agriculture, Forestry, Cooperative and Rural Development in South Sudan

platforms is fast-tracking research within the regional NARS and reducing the need for scientists to leave Africa to do their work.

Working to shape to continent-wide processes, BecA-ILRI Hub staff joined CGIAR research scientists, policymakers, and representatives of higher education networks and the private sector at a workshop to develop the concept of the the African Agricultural Research Programme (AARP). AARP is an initiative led by the Forum for Agricultural Research in Africa (FARA) to strengthen the continent's agricultural research systems for increased productivity, profitability and sustainability.

As part of our 2018–2023 strategy, the BecA-ILRI Hub will seek to play a leading role in the application of and support for biosciences in the region. A

landscape survey confirmed the comparative advantage of the BecA-ILRI Hub as an important regionally-valued bioscience facility. It identified opportunities to enhance our role in helping set the bioscience agricultural research agenda, as well as an advocate for the government funding of NARS work in bioscience technologies and services.

The coming year will, therefore, be characterized by engagement with key stakeholders to guide the development of our new five-year plan. We remain committed to helping Africa use biosciences as a means of transforming agriculture, bridging the gap between population growth and agricultural productivity on the continent. To the readers of this report, we hope you will accompany us on this grand AR4D journey in Africa. To our many partners and donors, thank you for your support.

Jimmy Smith

Director General, ILRI



Appolinaire Djikeng

Director, BecA-ILRI Hub



The BecA-ILRI Hub's regional focus with top scientists drawn from the region and the world enables research to link to application in a way that current financiers demand, demonstrating impact. Perhaps the next phase for international AR4D is a wider base of financiers and greater integration of regional and world expertise focused through regional centres of excellence such as the BecA-ILRI Hub.

Lindsay Falvey, chair, ILRI board of trustees during BecA@15 celebrations 2016



Marguerite Niyibituronsa from Rwanda manning a display during the BecA@15 celebrations

BecA-ILRI Hub celebrates 15 years as a **regional centre** for **excellence** in biosciences

4

The BecA-ILRI Hub celebrated 15 years as an African centre for excellence in agricultural biosciences in February. The event reflected our achievements in mobilizing bioscience-based innovations to improve livelihoods and build resilient agro-based economies in Africa. It was also an opportunity to cast the vision that will ensure the relevance and sustainability for the next decade.

The celebration, held at ILRI's Nairobi campus, attracted 241 participants from across the globe and was officially opened by Willy Bett, cabinet secretary in Kenya's Ministry of Agriculture Livestock and Fisheries. Notable participants at the event included Ibrahim Mayaki, chief executive officer of the New Partnership for Africa's Development (NEPAD) Agency. David Angell, Canadian High

Commissioner to Kenya and John Feakes, Australian High Commissioner to Kenya represented the BecA-ILRI Hub donor group as co-conveners of the event. Other donors represented at the event included the Bill & Melinda Gates Foundation (BMGF), the UK Department for International Development (DFID); the Syngenta Foundation for Sustainable Agriculture, the Swedish Government; Swedish International Cooperation Development Agency (Sida); and the UK Biotechnology and Biological Sciences Research Council (BBSRC).



Left, Appolinaire Djikeng, Gabrielle Persley, Jimmy Smith, Eugene Terry and Romano Kiome

Right, Ibrahim Mayaki (NEPAD CEO) addresses a session during BecA@15. Looking on John Feakes, Australian high commissioner to Kenya and ILRI director, Jimmy Smith





Dignitaries who attended the BecA-ILRI Hub 15th anniversary celebrations in February, 2016

Discussions highlighted the opportunities for increased national budgetary allocations to research and the growing role of the BecA-ILRI Hub in defining continental agricultural priorities for advanced bioscience research. Participants also talked about the opportunities for partnerships with advanced research institutions for capacity development and the transfer of technologies to Africa through the BecA-ILRI Hub.

The climax of the celebrations was the recognition of the achievements of the alumni of the BecA-ILRI Hub's ABCF fellowship program who have emerged as science leaders. Charles Masembe, associate professor at Makerere University, Uganda; Ruth Wanyera, national wheat coordinator at the Kenya Agricultural and Livestock Research Organization (KALRO), Alexander Bombom, researcher with Uganda's National Agricultural Research Organization (NARO) and Mercy Kitavi, molecular breeder and capacity building scientist at the International Potato Center (CIP); talked about the impact of their connection with the BecA-ILRI Hub on their research and in their institutions.

Eminent people in BecA-ILRI Hub's history including Jimmy Smith, director general of ILRI; Appolinaire Djikeng, director of the BecA-ILRI Hub; Romano

Kiome, former permanent secretary in Ministry of Agriculture, Kenya; Gabrielle Persley, Crawford Fund research director; Eugene Terry, BecA-ILRI Hub advisory panel chair; and Segenet Kelemu, former BecA-ILRI Hub director, shared perspectives on the future role of the BecA-ILRI Hub in Africa's research and agricultural development. Discussion panelists included Robert Pukose, Member of Parliament for Endebess, Kenya; Ayo Ajayi, BMGF Africa team director; Dale Sanders, director of John Innes Centre (JIC) and Margaret Karembu, director, International Service for the Acquisition of Agri-biotech Applications (ISAAA)-AfriCentre.

Beyond the celebrations, the BecA-ILRI Hub continues to pursue the vision of an agriculture-led social and economic transformation of Africa through its contribution to increased institutional and human capacity, shared knowledge and facilities, and the increased investment in and support for the national, regional and continental science initiatives driving agricultural growth on the continent.

Supporting **African-led agricultural research** to drive economic growth

Over the last 15 years, the BecA-ILRI Hub has developed a research and development agenda supporting the transformation of agriculture to drive economic growth in Africa. Through consistent engagement with NARS, the BecA-ILRI Hub has kept abreast of emerging priorities and new opportunities as agriculture evolves into a profitable enterprise in the growing economies of many African countries.

Scaling up the use of **Brachiaria** grass as a **key forage** in Africa

On-farm evaluations in Kenya and Rwanda have confirmed that the use of Brachiaria grass extends forage availability for livestock by up to three dry months. These evaluations also confirmed previous observations of increases in milk production and weight when cattle are fed on Brachiaria grass.

Over 6,000 farmers in both countries are growing the four best-bet Brachiaria varieties (*Basilisk*, *MG4*, *Piatã* and *Xaraés*), which were identified through the use of a participatory approach with key stakeholders. These varieties are being concurrently scaled out in Kenya and Mali by the Accelerated Value Chain Development (AVDD) dairy project, funded by the United States Agency for International Development (USAID) Feed the Future Initiative. There is growing interest and a push to adopt Brachiaria grasses in other countries including Botswana, Cameroon, Mozambique, Namibia and Somalia.

This research has identified potentially beneficial bacteria that occur naturally within the grass (bacterial endophytes). The endophytes could

be useful: increasing production of hormones that regulate: plant growth and boost biomass production in Brachiaria; improving soil nutrient solubility and soil fertility; enhancing drought tolerance; and improving the overall health of the grass. These endophytes are currently being evaluated under greenhouse conditions for their ability to confer drought tolerance to Brachiaria.

To ensure the transfer of technologies to national programs, seven researchers from five East African countries were trained on forages biotechnology through the Brachiaria program. After periods of between six and nine months at the BecA-ILRI Hub the NARS researchers returned to their home institutions with transferable skills acquired through the training. An in-depth external review of the program concluded that it has made significant contributions to the improvement of forage availability and livestock productivity in the aforementioned program countries.

Sita Ghimire of BecA-ILRI Hub (l) shows the experimental Brachiaria grass fields to Paul Hagermand and Lori Stewart of the Canadian Food Grains Bank

The program on climate-smart Brachiaria grasses for improving livestock production in East Africa is funded by the government of Sweden through Sida.

The research is led by the BecA-ILRI Hub and implemented in partnership with KALRO, Rwanda Agriculture Board (RAB), International Center for Tropical Agriculture (CIAT), Grasslanz Technology Limited and AgResearch.



Tracking **virus evolution** to enhance the prevention of **cassava mosaic disease**

8

Gabriela Chavez from Auburn University has been working on the Cassava virus evolution project at the BecA-ILRI Hub, alongside African scientists

An international partnership launched at the BecA-ILRI Hub in 2016 brought together scientists from East Africa and the USA to examine the evolution of cassava mosaic viruses as an approach to tackling the cassava mosaic disease (CMD). The project complements efforts led by the International Institute of Tropical Agriculture (IITA) to combat CMD and cassava brown streak disease (CBSD) in sub-Saharan Africa by developing disease resistant cassava varieties.

CMD is responsible for between 12 and 23 million tonnes of crop yield losses in Africa where cassava is a staple food for over 250 million people. Cassava mosaic viruses, like other viruses, have an exceptionally high mutation rate, rapid replication and recombination. This characteristic has enabled them to adapt to different environmental conditions over time and break plant resistance, confounding efforts to combat CMD.

The Cassava Virus Evolution Project is one of the most detailed studies of virus evolution ever conducted globally and is expected to make ground-breaking discoveries relevant to other viruses with significant economic and health impacts such as the dengue virus. This cassava virus evolution research partnership is an example of north-south and south-south collaborations fostered by the BecA-ILRI Hub, which are providing training and capacity-building support for African researchers.

In 2016, entomologists George Kennedy from NCSU and Alana Jacobson from Auburn University spent a month at the BecA-ILRI Hub to start the project and Linda Hanley-Bowdoin (NCSU), the project leader, visited the Hub to mentor and monitor research progress.

From mid-2016, two post-doctoral scientists, Gabriela Chavez from Auburn University, and William Sharpee from NCSU, have been working on the project alongside African scientists including Joseph Ndunguru, from MARI who has years of experience in cassava research.

Established with funding from the National Science Foundation Partnerships for International Research and Education (NSF-PIRES), the Cassava Virus Evolution Project brings together scientists from Auburn University, North Carolina Agricultural and Technical State University, North Carolina State University and Rutgers University in USA; the Mikocheni Agricultural Research Institute (MARI), and Nelson Mandela African Institution of Science and Technology (NM-AIST) in Tanzania; and the BecA-ILRI Hub.

Investigating the role of **bushmeat** in the transmission of **zoonotic diseases** in Tanzania

An outcome of the BecA-ILRI Hub's Swedish funded initiative to strengthen infrastructural and human capability at NM-AIST, was the awarding of a grant to the institution by the US Defense Threat Reduction Agency.

The NM-AIST School of Life Sciences and Bioengineering and a consortium of partners including the BecA-ILRI Hub received a grant to investigate the role of bushmeat in the transmission of six pathogens between animals and humans in Tanzania.

Antelopes, zebra and wildebeest grazing in Tanzania's Serengeti national park. These are among the wildlife harvested for food in Tanzania's bushmeat trade.

An interdisciplinary and multi-institutional team of scientists from Tanzania, Kenya and the US are using state-of-the-art techniques to map the distribution of anthrax, ebola, marburg and monkeypox viruses as well as *Brucella* and *Coxiella* in bushmeat in Tanzania. The team assesses the biological risk and potential for impact on human health from these diseases.

The BecA-ILRI Hub provides capacity building, expertise and technology for the microbiome component of the project using the genomics platform. In May 2016, during a week-long workshop facilitated by the BecA-ILRI Hub at NM-AIST, Francesca Stomeo provided training on the theory and practice of the genomics pipeline to be used in the project.

The US Defense Threat Reduction Agency is funding the research on bushmeat in Tanzania for three years (2016–2018). Project partners include: BecA-ILRI Hub; Frankfurt Zoological Society; National Health Laboratory of the Tanzania Ministry of Health and Social Welfare; NM-AIST; Pennsylvania State University; Sokoine University of Agriculture; Tanzania National Parks; and Tanzania Wildlife Research Institute.

Bridging the knowledge gap in the **amaranth processing industry** in Kenya

Over the years, a project enhancing household nutrition through low-cost, sustainable processing of amaranth in Kenya and Tanzania has built a unique network of millers, farmer groups and industry. This network has contributed to the increased adoption of amaranth-based foods and revealed knowledge gaps in Kenya's amaranth processing industry.

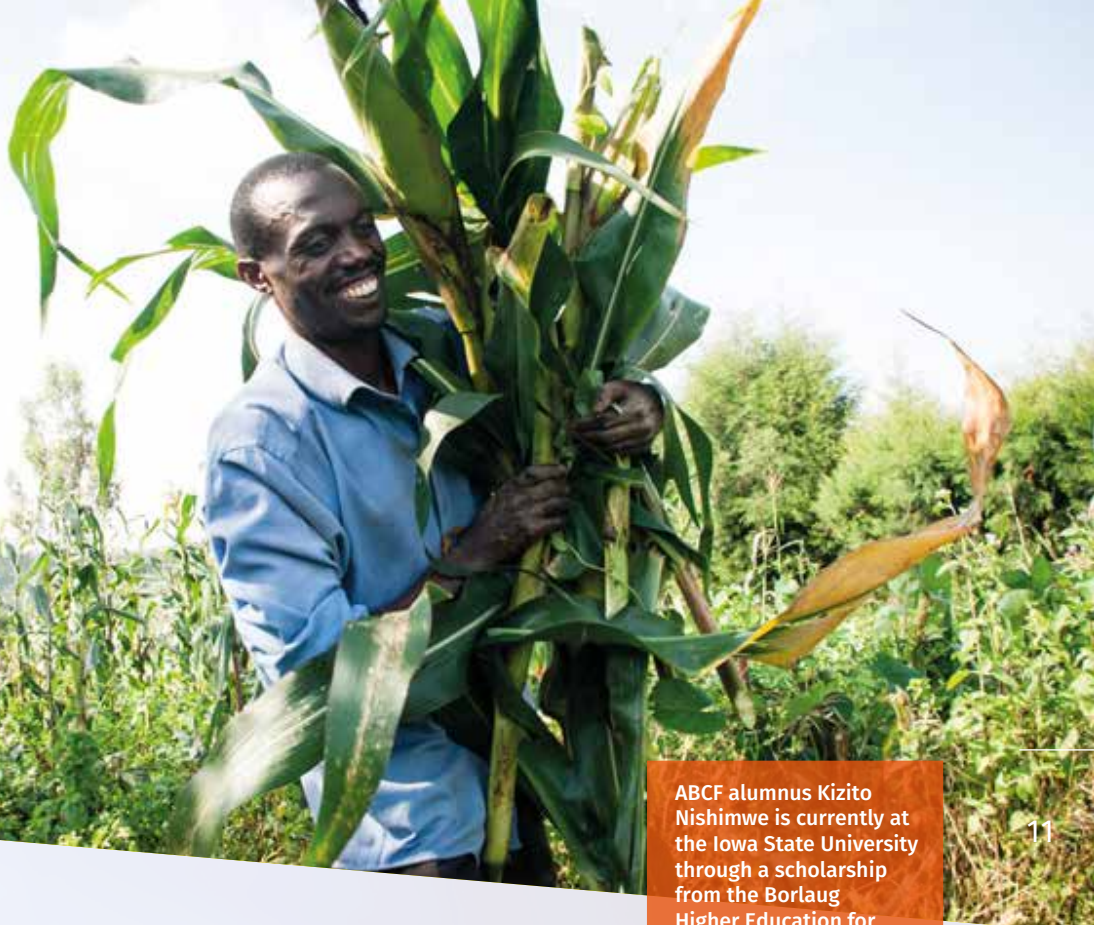
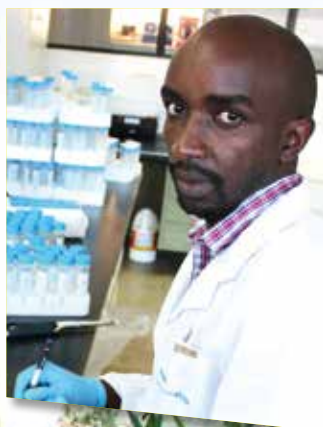
Findings from the project showed that most millers in the network blend grain amaranth with maize flour using arbitrary formulations and admit to labelling products with nutritional profiles not based on laboratory tests. As a result, some of the amaranth-based products in the market did not meet critical food safety requirements, and there was

little knowledge on legislation for composite flour production or fortification of maize and wheat flour.

A one-day training in October 2016 exposed processors of amaranth products and amaranth composite flour millers in Kenya to best practices in milling and the current legislation. The 18 participants were equipped with skills in identifying key food safety hazards in a food processing plant and information on the best manufacturing practices and food hygiene standards. The hands-on training ensured that participants were conversant with the legislation governing food production in the country and, by the end of the training, could develop and implement hazard analysis and critical control point (HACCP) and good manufacturing practices (GMP) within their operations. A field trip to a commercial miller introduced participants to different types of milling processes, plant layout and milling procedures in a medium-level milling company.

Daniel Sila, project leader and BeCA-ILRI Hub partner who also lectures at the Jomo Kenyatta University of Agriculture and Technology (JKUAT), organized the training. Overall, 34 people participated comprising small- and medium-scale millers, representatives from the Kenya Bureau of Standards, the Ministry of Health Department of Nutrition, Micronutrient Initiative Kenya, Global Alliance for Improved Nutrition, Kenyatta University Department of Nutrition, farmer groups, and others.

The 'Adding nutrition to African diets through low-cost sustainable processing of amaranth' project, is funded by the Australian government and implemented in partnership with the JKUAT in Kenya; Sokoine University of Agriculture, Tanzania; the World Vegetable Centre, Tanzania; the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia; and Annico Enterprises, Kenya.



ABCF alumnus Kizito Nishimwe is currently at the Iowa State University through a scholarship from the Borlaug Higher Education for Agricultural Research and Development (BHEARD) program.

Enhancing aflatoxin detection for safer maize in Rwanda

By Kizito Nishimwe, BecA-ILRI Hub alumnus and lecturer at the School of Food Science and Technology at the University of Rwanda's College of Agriculture, Animal Sciences and Veterinary Medicine

Maize is a leading food crop in Rwanda, representing 60 per cent of the cereals produced in the country. Its production has risen steadily from 120,000 tonnes of grain produced in 2006 to over 500,000 tonnes in 2011 according to Rwanda's National Institute of Statistics. However, maize is susceptible to accumulation of aflatoxins, toxic chemicals produced by a fungus. Hazardous to humans when eaten at high levels, these toxins have been associated with cancers, suppressed immune systems, reduced nutrient absorption and the stunting of children.

In 2014, I received an ABCF fellowship from the BecA-ILRI Hub to conduct research that would help fill gaps relating to aflatoxin detection in maize in Rwanda. During the first East African Conference on Food Science and Technology, in March 2016, and at the FARA 7th Africa Agriculture Science Week (AASW7) and General Assembly held in June 2016, in Kigali, Rwanda, I presented my findings to national policy stakeholders, including the Rwanda National

Agricultural Export Development Board, the Ministry of Agriculture and Animal Resources, Rwanda Agriculture Board (RAB) and Rwanda Standards Board (RSB), as well as to international, regional and national researchers.

My research will greatly contribute to strategies being put in place to ensure safer maize in the value chain in Rwanda. Further support is being provided by the BecA-ILRI Hub, which has donated aflatoxin-testing kits to progress research in this area by my home institution.

The advanced skills in aflatoxin research that I gained through the ABCF fellowship have enabled me to secure a PhD scholarship at Iowa State University under the Borlaug Higher Education for Agricultural Research and Development (BHEARD) program. I have also secured a one-year grant to facilitate the development of management strategies for minimizing aflatoxin levels in animal feed. The grant is supported by Feed the Future Innovation Lab for Livestock Systems-University of Florida and is a collaborative effort between Iowa State University, the University of Rwanda and the BecA-ILRI Hub.

Bioscience training: **accelerating research, strengthening science leadership** and shaping Africa's agriculture policy

12

In 2016, through the ABCF program, the BecA-ILRI Hub provided high-end, customized biosciences training and access to cutting-edge research technologies to more than **200** researchers.

The ABCF NARS-led research was distributed across the five BecA-ILRI Hub research themes of livestock productivity (**41%**); crop improvement (**42%**); climate change mitigation (**9%**); food safety and nutrition (**5%**); and the exploitation of under-utilized crop and livestock species (**3%**).

The ABCF program operates at the critically important intersection between AR4D, food security, and individual and institutional capacity building. The program is a catalyst for the deployment of high-quality bioscience to deliver food security, biosecurity and human health outcomes, directly contributing to the United Nations Sustainable Development Goals (SDGs) 1, 2, 3, 5 and 13. Networks of ABCF alumni established with the support of the BecA-ILRI Hub crystallized into CoPs around key research themes responding to SDGs 1, 2 and 13.

Through the CoPs, the investment in the ABCF program gained momentum as regional institutions benefited from enhanced research capabilities and strategic networks established by returning fellows. Since their establishment, the CoPs have worked to improve local chickens, pig and taro productivity, harness goat diversity and tackle ticks and tick-borne diseases. Each CoP is coordinated by ABCF alumni from one of the at least four participating countries.

Enhanced capacities of institutions receiving support through the ABCF program has led to the recognition of their science leadership potential by regional and international bodies. NM-AIST received two grants of USD 6 million each under the World Bank centres of excellence—water, energy and environment, and life sciences. The selection of University of Dschang in Cameroon by the African Union Interafrican Bureau for Animal Resource (AU-IBAR) and the Central African Regional Economic Commission as the principal genebank for animal genetic resources in Central Africa was as a direct result of the institutional capacity building provided by the BecA-ILRI Hub. The university is now considered a leading publicly-funded institution in Cameroon, especially in terms of its partnerships.

In developing science leadership, the ABCF program has had an impact on livestock and crop policy. A study on MLND by Francis Mwatuni, senior officer at the Kenya Plant Health Inspectorate Services (KEPHIS), provided a better understanding of the causal agents of the disease. This information was incorporated into the screening of resistance in maize for the very diverse causal agents of MNLD. Additionally, KEPHIS staff received training in advanced screening techniques. Jane Githinji, head of the Kenya Directorate of Veterinary Services

THE ABCF CONTRIBUTES TO MANY SDGS AND IN PARTICULAR TO:



BecA-ILRI Hub's Leah Kago working alongside Jean Ristaino, a leading scientist from NCSU

Virology laboratory, applied the lessons she learned from diagnostics and bioinformatics training to her research on Gumboro disease in chickens. This enabled her to differentiate between strains of this extremely virulent disease that affect even vaccinated birds. Her work has led to the development of policy on better hatchery disease management and certification and is expected to inform government strategies for the control of Gumboro disease in Kenya.



Through mutual engagements with the African Women in Agricultural Research and Development (AWARD) program and the International Foundation for Science (IFS), the ABCF program has extended its reach to special interest groups including women researchers and early career scientists from non-BecA countries such as Côte d'Ivoire and Nigeria.

Partnerships with advanced research institutions in Sweden, UK and USA significantly enriched the annual training workshops by adding new perspectives and approaches. By partnering with Jean Beagle Ristaino, a William Neal Reynolds distinguished professor and director of the NCSU Emerging Plant Disease and Global Food Security Cluster, a new module on the rapid diagnosis of Phytophthora—a parasitic plant pathogen causing environmental damage and enormous financial losses worldwide—was added to the 'Introduction to molecular biology and bioinformatics training workshop'. Crop breeders from Burundi, Rwanda, Uganda and Tanzania—due to a partnership between the BecA-ILRI Hub and the Australian Centre for International Agricultural Research (ACIAR)—received the opportunity to participate in this advanced genomics and bioinformatics training workshop.

Research at BecA-ILRI Hub supports vaccine development policy in Kenya



By **Jane Githinji**, *assistant director of veterinary services, Kenya and ABCF alumnus*

As head of the virology laboratory at the Central Veterinary Laboratories in the Directorate of Veterinary Services (DVS) in Kenya, my responsibilities include laboratory surveillance, and confirmation and reporting of animal viral diseases. My reports form the basis upon which disease control strategies are developed. It is, therefore, of the utmost importance that these reports reflect the true picture of the disease situation in the country, from which appropriate disease control policies and strategies can be derived.

Like in most developing countries, poultry farming in Kenya is mainly in the hands of the smallholder

rural poor, mostly women and young people, and is usually the only livelihood source for smallholder farmers. Outbreaks of infectious viral diseases that cannot be treated pose a major constraint on poultry production. Vaccination is the recommended method of control for these diseases. But vaccines do not always prevent occurrence of a disease.

The apparent failure of vaccines to protect chicken from infectious bursal disease (IBD) got me interested in understanding the cause of the disease despite prompt vaccinations by farmers (IBD causes immune suppression, making chicken more prone to other infectious diseases). I wanted to improve my understanding of the epidemiology of IBD in Kenya, starting with the comparative molecular characterization of the circulating viruses with the currently used vaccine virus strains.



The facilities available at the central veterinary laboratory are suitable for carrying out basic molecular analysis. However, to undertake more advanced molecular research required to gain a better understanding of IBD viruses circulating in Kenya, I needed access to the facilities at the BecA-ILRI Hub. Under the mentorship of the BecA-ILRI Hub scientists, in a very conducive research environment as an ABCF fellow, I learned many skills, including sequence editing and analysis, primer design, scientific paper writing and communicating science to non-scientists. These crosscutting skills will be very useful in improving my diagnostic capacity, and ultimately, scientific data collection for policy development at the DVS.

Based on the feedback and recommendations I gave to the DVS director, I am confident my research findings will form the basis for developing effective IBD control strategies, including diagnosis, vaccination, hatchery surveillance and certification, IBD vaccines registration and vaccine production. Implementation of such strategies will have far reaching impacts on poultry production, poverty alleviation, nutritional security, economic empowerment for women and young people, and self-employment. Reducing antimicrobial residues in poultry products will also contribute to a reduction in antimicrobial drug resistance in humans.

With my newly acquired skills, I will be able to contribute more to livestock research: science, technology and innovation. I am a better mentor to young people, a better leader and manager, a more fulfilled person, and, above all, an asset to my country. My time as an ABCF fellow marked the beginning of what I believe will be a journey full of discoveries, networking, research development and fulfilment.



15

The state-of-the-art facilities at the BecA-ILRI Hub act as a magnet for biosciences research in the region

2016 ABCF program achievements

Accelerating NARS-led research and innovation

10

research fellows accessed the BecA-ILRI Hub with funding from national and regional research institutions, and government ministries

Researchers came from

34

African NARS

68

Researchers hosted through the ABCF program

16

African countries represented



6

 **PLOS**
ONE

A peer-reviewed, open access journal

29

papers published in scientific journals from research partly supported by the ABCF program

Contributing to scientific knowledge

300+

NARS research scientists trained in Bioinformatics. *E-Biokits* installed in **5** NARS institutions across **4** countries



Ten years of partnering with SLU, Sweden

Strengthening capacity of NARS to drive research and innovation through training workshops



343

NARS scientists trained through hands-on skill-enhancement workshops

Magnet for high-end bioscience: capacity building, research, technology platforms

200+

visitors to BecA resulting in major partnerships. **5** university consortia funded by World Bank ACE II chose ABCF model to train over **100** research scientists at MSc and PhD level

Training Africa's next generation of scientists



ABCF fellows' work at the BecA-ILRI Hub contributed to successful completion of MSc or PhD studies in national universities

Supporting women science leaders across Africa



GENDER at BecA-ILRI Hub

By partnering with the AWARD program, the ABCF program supported women scientists beyond the BecA countries

24

participants attended from Burundi, Cameroon, Congo, Ethiopia, Ghana, Kenya, Madagascar, Nigeria, Rwanda, South Sudan, Sudan, and Uganda

Introduction to lab management and equipment operations



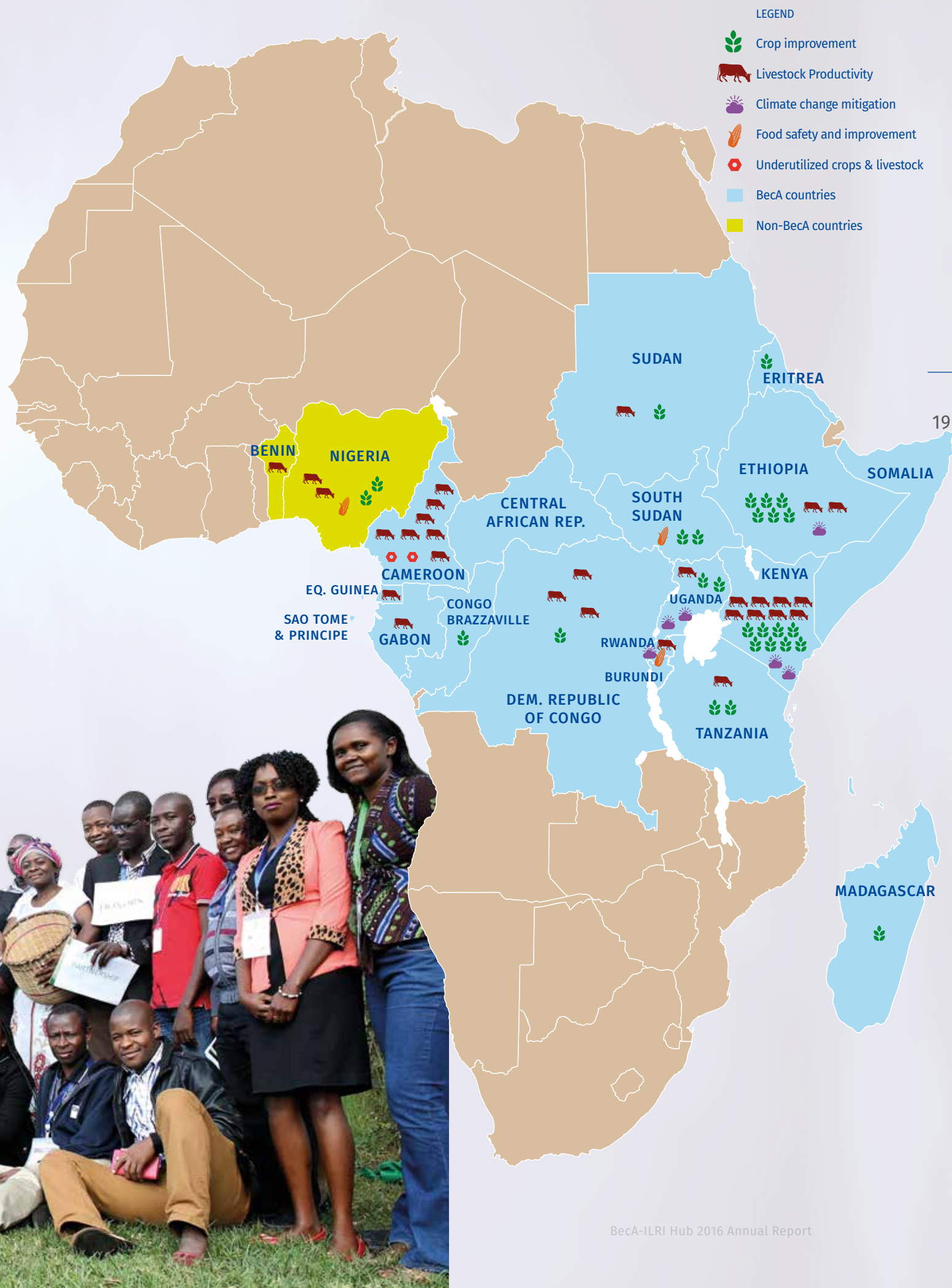
4

ABCF alumni/NARS-led communities of practice on pig, local chicken, taro and goat

Mobilizing NARS capacities for joint actions

Africa NARS-led research under the **ABCF** program in **2016**





Africa Biosciences Challenge Fund **mobilizing capacities** for joint action

Communities of practice

A key component of the ABCF program is to mobilize bioscience capacities in NARS for joint actions to tackle the key food security challenges in Africa. The program facilitates the creation of CoPs among NARS researchers enabling them to take a comprehensive and holistic view of their research challenges as they jointly develop resource mobilization strategies and explore the role of institutions in collectively addressing agricultural challenges on a larger scale.

The NARS scientists at the BecA-ILRI Hub work on individual projects aligned to national priorities. The BecA-ILRI Hub facilitates connections between projects from different institutions and countries that are addressing similar challenges. Once common areas of interest are established, one of the members is identified to coordinate community discussions and eventually act as the steward of the CoP.

The partnerships catalysed in this way are designed to leverage human and institutional resources across countries for joint action, providing support to the NARS researchers beyond their placement at the BecA-ILRI Hub.

By connecting researchers and institutions working on different aspects of the same agricultural product or value chain, the ABCF has established communities that are able to tackle priority concerns faced by many countries within or across regions.

Existing CoPs include the local chicken genetic research for development, with membership from Benin, Cameroon, Chad, Central Africa Republic, Democratic Republic of the Congo (DRC), Gabon, Ghana, Kenya and Rwanda. Under the stewardship of ABCF alumnus Christian Keambou Tiambo from the University of Buea in Cameroon, the CoP has submitted a proposal for a USD 1 million grant to the African Union.

Other CoPs led by the ABCF alumni undertake research on goat genetics, taro improvement, African swine fever and improved forages.

Co-sponsoring Carnegie fellowships for technology and skills transfer

In 2016, the BecA-ILRI Hub co-sponsored three scientists for the 'Carnegie Africans in the Diaspora Fellowship Program'.

Animal genetics and genomics Samuel Aggrey and Romdhane Rekaya, professors at the University of Georgia, were awarded the fellowship that enabled them to engage in research collaboration, teaching and technology transfer activities with the Hub and the University of Nairobi (UoN). Both professors are currently affiliate scientists with the BecA-ILRI Hub, providing scientific advice, supervision and training of NARS research fellows.

The two fellows, in collaboration with ILRI principal scientist Raphael Mrode, taught a course on 'Introduction to animal quantitative genetics and genomics'. First taught in 2015, due to high levels of demand, the course has been incorporated into the BecA-ILRI Hub annual training calendar. The 2016 workshop was attended by 20 participants from eight African countries.

In collaboration with staff from the BecA-ILRI Hub and ILRI, the Carnegie fellows are currently developing a framework for the establishment of an African centre of excellence in quantitative genetics and genomics to be hosted by the UoN.

Global one health capacity building partnership

Professor Wondwossen Gebreyes, executive director of the Ohio State University Global One Health Initiative was awarded the fellowship to strengthen the capacity of institutions on the African continent to provide training on global one health approaches—optimal health for people, animals and the environment.

Through the fellowship, Gebreyes in collaboration with the representatives of BecA-ILRI Hub, UoN, KALRO and Kenya Medical Research Institute (KEMRI) developed an action plan to address global one-health research skills

Growing science leadership in Africa

Christian Keambou Tiambo



For the past 10 years, my laboratory and field research has sought to enhance the productivity of monogastric livestock (chicken, pig and rabbit) with the overall goal of improving the livelihoods of farmers in rural Africa. My research aims to promote the best use of locally available resources for livestock feed and health, and use participatory approaches in a community-based livestock program to advance knowledge in livestock genetic research for development.

My interaction with the BecA-ILRI Hub has grown my career starting from my initial ABCF fellowship in 2012 when I was part-time lecturer, to my appointment to various positions of responsibility and science leadership. I am now senior lecturer in animal breeding and genetic improvement at the University of Buea and the Université des Montagnes in Cameroon and lecturer in genetic engineering at the Pan African University Institute of Science, Technology and Innovation (PAUSTI) in Kenya. I serve as expert consultant for animal genetic resources management in Africa for Engineering Bureau of Animal Health and Production (BISPA), Cameroon. I am also a member of the Animal Genetic Resources Taxonomy Advisory Group for the African Union InterAfrican Bureau for Animal Resources (AnGR-TAG/AU-IBAR), and focal person at

the Faculty of Agriculture and Veterinary Medicine of the University of Buea for the United States Agency for International Development (USAID) One Health Workforce program.

As an ABCF alumnus, I steward the Local Chicken Genetic Research for Development (LCGR4D) CoP hosted by BecA-ILRI Hub. This CoP brings together researchers working on indigenous chicken from 10 countries in western, central and eastern Africa. The team is made up of students, postdoctoral fellows, technicians and senior scientists working with co-investigators in livestock genetics and genomics to discover and exploit novel genes with potential impact on indigenous chicken productivity, adaptability and disease resistance.

I credit the BecA-ILRI Hub with giving me a springboard to advanced research and science leadership. The experience and mentorship given through the ABCF program broadened my thinking and helped me to set up networking opportunities that resulted in the establishment of a dynamic chicken research CoP, which I believe will make a significant contribution to the improvement of livelihoods for smallholder farming communities across the continent.

gaps. Activities in the plan included a workshop on zoonotic, vector-borne and food-borne infectious diseases. The workshop participants included academic staff, postgraduate students and visiting scientists from BecA-ILRI Hub, ILRI, KALRO, UoN, KEMRI, International Centre of Insect Physiology and Ecology (icipe), and the Kenya Ministry of Agriculture Livestock and Fisheries's Directorate of Veterinary Services (DVS).

The seminars were delivered on various topics including on grant opportunities, proposal development, peer-review

process and grant management, the critical role of veterinarians in public health, and the challenges due to increasing antimicrobial resistance. A review of the university curriculum saw the introduction of a one health course for fourth year bachelor of veterinary medicine students and a molecular epidemiology course for masters of veterinary epidemiology and economics students.

Collaboration between KALRO and the BecA-ILRI Hub

By **Lusike Wasilwa**, Director, Crop Systems, KALRO

The BecA-ILRI Hub has provided a common biosciences research platform, research-related services and capacity building opportunities to KALRO scientists. Leveraging technological capabilities and human resources at the BecA-ILRI Hub, KALRO scientists have accelerated their research impact. Conducted through the ABCF fellowship program, this work includes research on major crop pests and diseases in Kenya like maize lethal necrosis, cassava mosaic disease, cassava brown streak virus and maize streak virus. An understanding

of the local strains of the pathogens that cause these diseases has been acquired and part of their genomes determined.

Supporting research

Through this collaboration, tools for identifying pathogens that cause food losses have been developed and tests validating their efficacy have been undertaken. Specifically, KALRO and the Hub jointly developed a diagnostic test for Capripox diseases. Additionally, a dedicated diagnostics platform has advanced research on mycotoxins in maize and other food grains.

Broader horizons

One of the greatest benefits of this collaboration is the exposure of KALRO's early career scientists to world-class-research facilities that accommodate highly advanced research. This has not only given them hands-on experience and access to findings and publications from a variety of agricultural disciplines, it has opened their minds to the array of opportunities available in this field.

A vibrant environment enriches the 'BecA-ILRI Hub experience' as the national researchers interact with a diverse community of scientists through participation in seminars by regional and international experts and skills enhancement workshops. Participation in a weekly forum





Research conducted by KALRO scientists through the ABCF program includes studies on major crop pest and disease in Kenya

offers research fellows the opportunity to receive constructive feedback from peers and senior scientists on their research design and presentation. There are also opportunities for the fellows to share their research directly with the donor community which frequent the BecA-ILRI Hub.

A significant aspect of KALRO fellowships at the BecA-ILRI Hub emphasizes product development and impact pathways. The BecA-ILRI Hub encourages fellows to formulate their projects to reach out the community and at times facilitates translation of research to impact, beyond the fellowship period, including through support for publication.

Looking ahead

I believe that a dedicated liaison office would help enhance the benefits of the KALRO-BecA-ILRI Hub collaboration, including by raising awareness among KALRO scientists of the vast research, technologies and capacity building opportunities available through this partnership.

Partnership to strengthen **One Health** research capacity in Africa

By **Kathrin Heitz-Tokpa**,
program manager AfriqueOne-ASPIRE

The BecA-ILRI Hub was selected in 2016 to participate as a capacity building partner in the Afrique One-African Science Partnership for Intervention Research Excellence (ASPIRE) program.

The objective of Afrique One-ASPIRE program, which runs from 2016-2021, is to build a world-leading pan-African research capacity in One Health science—ensuring better human and animal health and well-being, greater financial efficiencies and the development of environmental services through closer cooperation between human and animal health, and related disciplines and sectors. This goal will be achieved through a program of scientific training across five thematic training programs (TTPs)—rabies, brucellosis, mycobacterial infections, food-borne diseases and the surveillance response—and connecting academia and society in the co-production of knowledge to solve diverse society problems.

Core research skills in One Health research include statistics, modelling, health economics, experimental design, surveillance methodology, and molecular epidemiology. The BecA-ILRI Hub will build the capacities of Afrique One-ASPIRE masters and PhD students and post-doctoral fellows in molecular epidemiology. Training will be carried out at the Hub to address the common needs and skills of individual researchers, who will be hosted by the Hub for periods ranging from a few weeks to months, to support them in processing their samples and mining their data.

The ASPIRE program is the second phase of an African research consortium named Afrique One. It is among eleven beneficiaries of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa initiative grants. The DELTAS grants are led by the Alliance for Accelerating Excellence in Science in Africa (AESAs) and funded by a donor consortium that comprises the African Academy of Science (AAS), NEPAD, the Wellcome Trust and DFID, UK.



Advancing **cutting-edge research** in Africa

Growing research and research investment by regional programs has also opened the BecA-ILRI Hub facilities to new users. In 2016, five NARS researchers accessed BecA-ILRI Hub facilities using their own self-sourced funding and worked with limited supervision. This shift from dependence on the ABCF fellowship program demonstrates increased capacity not only in resource mobilization, but also in enhancing research capabilities.

24





Over the years, the BecA-ILRI Hub has maintained an agreement with reagent suppliers Inqaba Biotech, for a freezer program housed at the bioscience facility. The freezers contain commonly used molecular biology reagents available for immediate use. The freezer program addresses the challenges of the long shipment and clearance periods that have in the past delayed research by up to a month.

Beyond the freezer program, the BecA-ILRI Hub's networks with suppliers have proved critical to national programs needing to build their own base of suppliers. The annual Introduction to principles of laboratory management and equipment operations, which hosted participants from 12 countries, highlighted the challenge of the supply chain as a major research constraint. To address this problem, the BecA-ILRI Hub facilitated connections between its trusted suppliers and the NARS.

Another challenge commonly faced by NARS is the maintenance of equipment. The BecA-ILRI Hub organized the first facilities and equipment maintenance workshop for NARS engineers in the region. The workshop was largely facilitated by

the ILRI engineering unit which is responsible for facility and equipment maintenance. During the workshop, the NARS engineers were trained on laboratory architectural design, preventative maintenance of specific equipment, development of annual preventative maintenance plans and auxiliary power systems.

Growing research and research investment by regional programs has also opened the Hub facilities to new users. In 2016, five NARS researchers accessed BecA-ILRI Hub facilities using their own self-sourced funding and worked with limited supervision. This shift from dependence on the ABCF fellowship program demonstrates increased capacity not only in resource mobilization, but also in enhancing research capabilities.

Due to the increased awareness of its presence in the region, the BecA-ILRI Hub hosted more than 30 regional and international scientists in 2016. In the same year, the BecA-ILRI Hub received over 100 visitors who came to gauge the kind of research activities their institutions could implement at the shared facility. As a result, the BecA-ILRI Hub is increasingly included as a technical partner in various proposals by African NARS.



biochemistry
extracellular abstract
chromosomal
complex biological
incubators illustration motif database
detection
biophysics homologous
nucleotide technique
biotic mutations data cellular model imagery polymorphism modeling species orchestration system statistical
bioinformatics
amino fragments standalone protein assembly computational gene open tags spectroscopy expression information
hemoglobin concept
rotatable
software
evolutionary
biomedical algorithms



Marking 10 years of training bioinformaticians in Africa

This celebration is a culmination of lessons and challenges we have overcome in the past decade in the process of empowering African researchers to use computer technology to manage biological information.

We later realized the need to create an internet-independent bioinformatics platform containing all the necessary databases to give the trainees a feel for, and access to, the vast resources available online.

Erik Bongcam-Rudloff, head of SLU-Global Bioinformatics Centre



The BecA-ILRI Hub and the Swedish University of Agricultural Sciences (SLU) celebrated 10 years of collaboration in enhancing the capacities of African NARS in bioinformatics.

Erik Bongcam-Rudloff, head of SLU-Global Bioinformatics Centre, reflected on the challenges, achievements and vision of the partnership that gave birth to an advanced bioinformatics and genomics workshop organized annually by the BecA-ILRI Hub and SLU in Nairobi that attracts participants from across Africa.

‘This celebration is a culmination of lessons learned and challenges overcome in the past decade in the process of empowering African researchers to use computer technology to manage biological information,’ he said.

‘The first bioinformatics course by the two institutions took place at the ILRI Nairobi campus in 2006 after the approval of a proposal to the Swedish International Development Cooperation Agency (Sida) by Etienne De Villiers, former bioinformatics group leader at the BecA-ILRI Hub and myself, representing SLU.’

‘In the first workshop, we drew a lot from my experience in teaching bioinformatics in Europe and South America. The tutorials were heavily internet-dependent and we had not anticipated the slow internet speeds in Africa at the time. The course was a success despite this challenge and in 2007, we used a different approach to the training including using USB flash drives preloaded with the Linux system that allowed the trainees to simulate what happens on an online platform

‘We later realized the need to create an internet-independent bioinformatics platform containing all the necessary databases to give the trainees a feel of, and access to, the vast resources available online. Between 2008–2009 we developed the “e-biokit” to accomplish this. The portable bioinformatics platform contains a wide range of databases, software and tutorials used in biomedical and environmental research. Created at SLU, the e-biokit was further developed and deployed in Asia, Europe, South America and Africa and can be used not only in education but also in projects.

We have trained over 300 bioinformaticians in Africa in 10 years, a number that is growing exponentially as scientists realize the benefits and impact of interpreting biological research data.

New **technology platform** supports **crop** and **livestock breeders**

In 2015, with the support of BMGF, BecA-ILRI Hub began the process of establishing a platform that will help African national crop and livestock breeders harness genomic data to increase the efficiency of their breeding programs.

In 2016, the Integrated Genotyping Service and Support (IGSS) platform implemented in partnership with Diversity Arrays Technology (DART) Pty Ltd from Australia, was launched at ILRI's Nairobi campus. The launch was attended by more than 50 participants, including breeders, seed company representatives, CGIAR centre staff and researchers from 10 African countries, Australia and USA.

During his opening address at the launch, which received considerable media coverage, ILRI assistant director general Dieter Schillinger lauded the public-private partnership citing it as a pathway to ensuring the initiative's sustainability. Gary Atlin, senior program officer in the agricultural development initiative at BMGF and Appolinaire Djikeng, director of BecA-ILRI Hub, gave an overview of the IGSS vision. Technology manager Josephine Birungi highlighted the critical role the platform is anticipated to play in accelerating crop improvement in national breeding programs while Clay Sneller, IGSS lead plant breeder, explained the process of transitioning from traditional to molecular breeding. Andrzej Kilian, DART director outlined DART's approach to supporting agricultural research and practice through IGSS. Various scientists from CGIAR centres and national breeding programs explained how support from DART had the potential to shorten the cycles for the release of new improved varieties.

This platform has enabled researchers from the International Maize and Wheat Improvement Center (CIMMYT) gain a better understanding of the genetic basis for resistance to MLND—a devastating disease of maize causing up to 90% yield losses to farmers across East Africa. These findings will help speed up the development of MLND resistant varieties and identification of new sources of resistance to the disease, improving food security for millions of households in the region.

The platform also supported research by ILRI scientists on the survival of livestock under harsh environments common in the face of climate change. Data on the differences between Dorper and Red Masaai sheep in relation to: growth rates; resistance to parasites; and resilience will provide insights necessary for the development of more hardy breeds of sheep—a significant source of livelihoods and food for smallholder farmers and pastoralists.

Scientists from the International Institute of Tropical Agriculture (IITA) have acquired a greater understanding of the genetic diversity of cassava varieties in eastern and southern Africa using this technology. These researchers have identified markers linked to genes in cassava that confer resistance to two viral diseases currently ravaging the crop in eastern Africa—cassava mosaic disease and cassava brown streak disease. They will use the markers to speed up conventional breeding of improved, high-yielding cassava varieties that are tolerant to the two viral diseases.

The launch of the IGSS platform gave the technical team managing the platform an opportunity to get feedback from users and potential users on their experience as well as anticipated future applications of the service. Through a guided lab tour, participants witnessed the set up of the IGSS platform at the BecA-ILRI Hub facilities. The available range of services was also demonstrated by the IGSS operators who were trained by DART in Australia.



Samuel Ng'ang'a working on the IGSS platform at the BecA-ILRI Hub

A glimpse into the **future of crop breeding** in Africa



Clay Sneller, senior scientist-lead plant breeder at the Beca-ILRI Hub, IGSS platform

For more than 30 years, I have been involved in plant research and witnessed major developments in crop breeding. But most of these developments have serious limitations when applied in breeding for complex traits such as increased yield and stress tolerance. Genomic selection (GS) is the one new technology that I feel has the greatest potential to influence breeding for these difficult traits. The main reason for my enthusiasm is that GS does not try to reduce the genetics of these traits down to a few genes but effectively deals with their polygenic nature. More importantly, it can be immediately initiated in most breeding programs.

For many years, GS research was the realm of statisticians and was more theoretical than applied. But in recent years' breeders have demonstrated that the technology is living up to the hype: it really works! Furthermore, large seed companies now use GS as a routine breeding tool. The recently launched IGSS platform at the Beca-ILRI Hub is designed to facilitate the use of GS and other molecular breeding approaches in crop breeding programs in Africa. It is an ambitious plan that has the potential for tremendous impact on the well-being of many people in Africa.

The IGSS platform is offering all the technical services, expertise, and training necessary to facilitate a successful transition to molecular plant breeding. This move from traditional to molecular breeding is a journey that requires partnerships with and among breeders who are willing to take the needed steps to integrate it into their programs to make molecular plant breeding a widespread reality that will enable Africa to reap the benefits of this technology. To this end, a call for proposals has been issued to attract potential users of the service. The proposals will be the starting point for the IGSS/ breeder partnerships. By offering subsidized rates on genotyping costs, the IGSS will help the programs that

come on board initiate use of the available advanced breeding technologies. Additionally, the funding for this service has facilitated the establishment of strategic partnerships with maize and bean breeders in four eastern African countries—Ethiopia, Kenya, Rwanda and Uganda. Through these partnerships, we are providing the breeders with hands-on support throughout the entire cultivar development pipeline, enabling them to integrate molecular breeding techniques into their ongoing conventional breeding programs.

Through partnerships with individuals, a molecular breeding plan will be developed that is best suited to each breeder based on his or her crop, traits, resources, and program logistics. In addition to the call for proposals, we will be reaching out individually to many people in NARS, CGIAR Excellence in breeding platform, the DivSeek Initiative and private companies. Several partnerships have already been developed with a wide array of programs, breeders, and crops, and samples for genotyping have been received. Efforts are being made to form a community of practice for different crops so we can learn together and share data and germplasm.

The IGSS platform is offering all the technical services, expertise, and training necessary to facilitate a successful transition to molecular plant breeding

Breaking new grounds in **mycotoxin diagnostics** and **nutrition analysis** in Africa

The steady increase in demand for the use of the mycotoxin diagnostics and nutritional analysis platform has led to the broadening of the scope of analytical experiments it can accommodate. Strategic upgrades and acquisition of state-of-the-art, high-throughput technologies at the BecA-ILRI Hub have positioned the platform to meet the research needs of diverse users in the region and beyond, in the 'omics' era.

The mycotoxin diagnostics and nutritional analysis platform complements other technology platforms at the BecA-ILRI Hub, strengthening the capacity and contributing to transformation of NARS in plant and animal breeding programs. Scientists from the RAB; the Ministry of Agriculture and Food Security in South Sudan; Polytechnic School of Abomey-Calavi in Benin; and National Fisheries Resources Research Institute and Makerere University in Uganda are among those

who received support from the platform in 2016. Beyond Africa, the platform hosted researchers from the Scottish Rural College, Wageningen University and the University of Canberra.

Support to CGIAR centres remains a central role of the platform. The International Potato Center (CIP) Food and Nutritional Evaluation Laboratory (FANEL) hosted by the platform continues to conduct analyses of orange-fleshed sweet potato (OFSP)—a crop at the centre of the World Food Prize for co-laureate and CIP scientist, Jan Low—and OFSP derived products. The platform is also linking bioscience research with industry through the screening of nutritional characteristics of cereals (rice, sorghum); legumes (soybean, pigeon pea); and milk, which were materials for genetic breeding.

To ensure reliability of the results generated, international competitiveness and progress towards improved service provision, a plan for



The platform is also linking bioscience research with industry through the screening of nutritional characteristics of cereals.

certification and accreditation of the platform is being implemented. Glen Fox, an Australian scientist at the Centre for Nutrition and Food Science at the Queensland Alliance for Agriculture and Food Innovation (QAAFI), carried out a pre-audit of the platform. Fox was a key technical partner in the BecA-ILRI Hub and CSIRO-led Capacity and Action for Aflatoxin Reduction in Eastern Africa (CAAREA) research program. His over 10 years' experience working in an ISO accredited facility was instrumental in the establishment of the mycotoxin diagnostics and nutrition analysis platform.

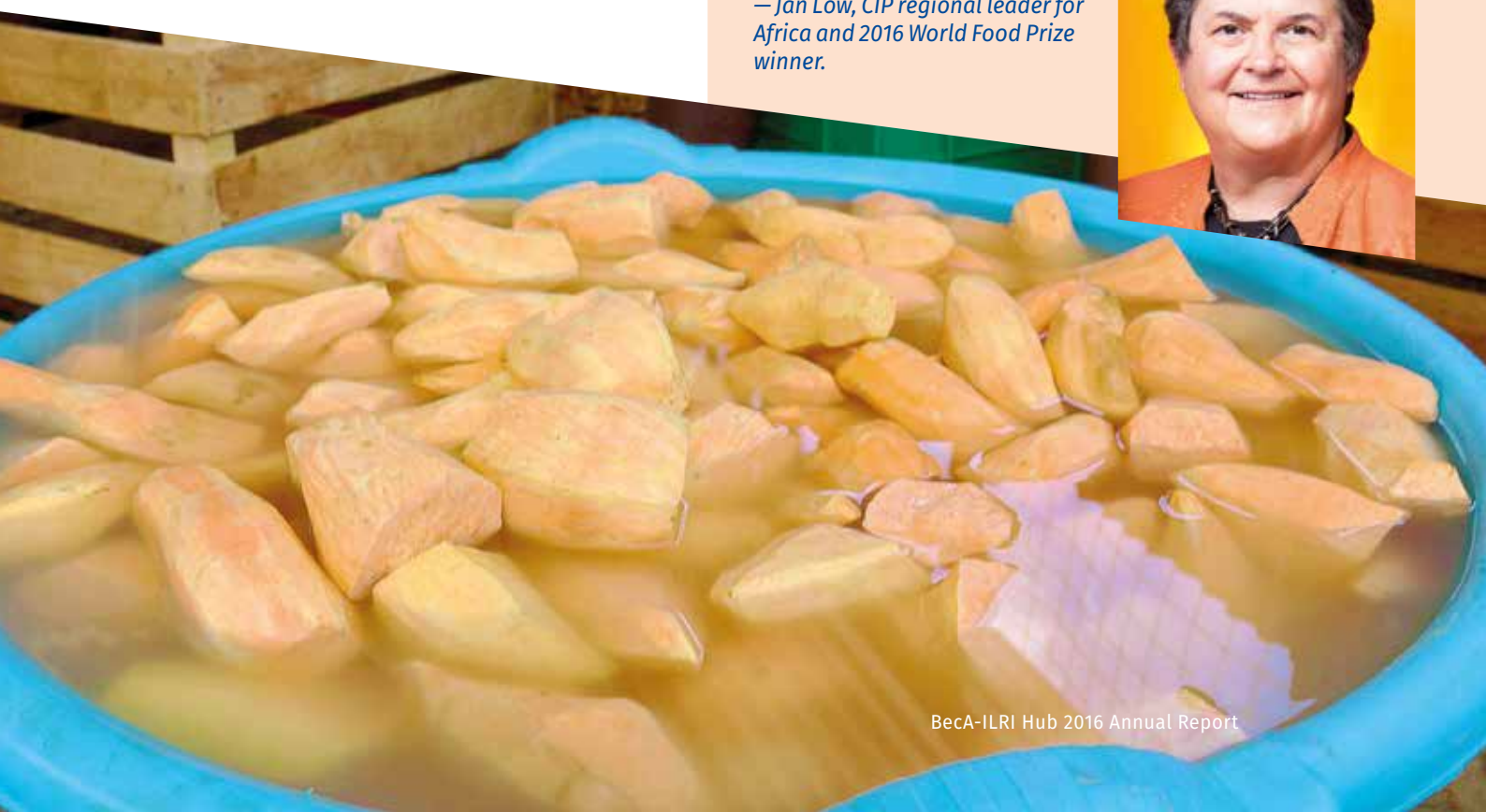
Looking ahead, a screening pipeline for resistance and susceptibility to Striga, an economically significant root parasitic plant, will leverage the platform's mass spectrometry capabilities in metabolomics studies alongside the capacities of the newly-launched IGSS platform. This pipeline will contribute to the development of continent-wide management programs for the parasitic weed that attack cereal crops—such as maize, sorghum, and millet, and legumes—greatly reducing production and endangering the food security and livelihoods of millions of farmers in sub-Saharan Africa.

Jan Low, World Food Prize laureate, sets her sights on **advanced sweet potato research** at the BecA-ILRI Hub

In 2016, Jan Low, regional leader for Africa at the International Potato Center (CIP), was recognized, as part of a three-member team, for the development of the single most successful example of micronutrient and vitamin biofortification—the OFSP. The BecA-ILRI Hub hosts FANEL and supports other research activities including the development of resistance to viral diseases and weevils in sweet potato and the application of genomics tools for sweet potato breeding.

“I see the BecA-ILRI Hub playing a key role in taking this award-winning work forward. Until we fully understand the complex genetic make-up of the sweet potato, we cannot find solutions to virus infection and susceptibility to drought. We are now part of a project that is sequencing the sweet potato genome to provide this understanding. Part of this work is being done at the BecA-ILRI Hub. The activities at FANEL are also set to grow as we venture further into OFSP product development and gain a better understanding of the nutrient contributions of various varieties.”

— Jan Low, CIP regional leader for Africa and 2016 World Food Prize winner.



Engaging with investors and an advisory panel

Andrew Tuimur, Principal Secretary, State Department of Livestock, Ministry of Agriculture, Livestock and Fisheries, Republic of Kenya, taken on a lab tour by ILRI scientist Nicholas Svitek

Advisory panel members

Eugene Terry Advisory panel chair, senior technical advisor of New Markets Lab

Tumusiime Rhoda Peace Commissioner for Rural Economy and Agriculture at the African Union

Yemi Akinbamijo Executive director of Forum for Agricultural Research in Africa (FARA)

Aggrey Ambali Advisor and head, the New Partnership for Africa's Development (NEPAD) Science Technology and Innovation Hub

Sir Edwin Southern Founder chairman and chief science advisor, Oxford Gene Technology

Theresa Sengooba Senior advisor to the Program for Biosafety system (PBS) hosted by the International Food Policy Research Institute (IFPRI)

Abdourahamane Sangaré Manager, Biotechnology and Bio-security Program of the West and Central African Council for Agricultural Research and Development (CORAF/WE CARD)

Vish Nene Director, vaccine biosciences program at ILRI

Appolinaire Djikeng Advisory panel secretary, Director of the BeCA-ILRI Hub

Third **Advisory Panel** meeting

The third BecA-ILRI Hub Advisory Panel meeting held on 28 October 2016 highlighted the significant progress in implementing the BecA-ILRI Hub's 2013-2018 business plan and advisory panel recommendations.

Panel members noted that a rich publication record indicated significant generation of knowledge through research by the BecA-ILRI Hub in collaboration with a wide range of partners. The published knowledge and information includes innovations addressing agricultural productivity and food security challenges by African scientists supported through the ABCF program.

The panel commended the establishment of three new technology platforms—the IGSS platform; the CIP FANEL; and the Golden Gate platform (technology transfer from the JIC, UK to facilitate the generation of DNA constructs for genome transformation and editing)—that have added to the region's technology capabilities.

The strong linkages being created within the region and with institutions outside of Africa, including those with JIC, NCSU and Queensland University of Technology, to support the delivery of the BecA-ILRI Hub's core activities were also lauded. Her Excellency Tumusiime Rhoda Peace, commissioner for rural economy and agriculture at the African

Union and AU's representative to the Advisory Panel, emphasized that the BecA-ILRI Hub has an especially relevant role in supporting capacity development and value addition in agricultural research on the continent.

Opportunities to define the scope and establish the role played by the BecA-ILRI Hub in contributing to global, continental and regional strategic goals were also identified. These include bringing cutting-edge bioscience to bear on African agricultural growth; developing a robust portfolio of BecA-ILRI Hub-led research; and the expanding the impact of the ABCF program through enhanced engagement with alumni upon return to their institutions.

The attraction of new investors including national governments, and regional and continental institutions was proposed as a way of consolidating and diversifying the BecA-ILRI Hub resource base. Further, the establishment of a mechanism for the BecA-ILRI Hub and its stakeholders to discuss bioscience policies, capacity development and key research areas was prioritized. Such a forum will also contribute to the establishment of modalities for sustainable funding.

Advisory panel member Rhoda Peace Tumusiime, Commissioner for Rural Economy and Agriculture at the African Union seated next to ILRI director general Jimmy Smith (right) in discussions with deputy director general-integrated sciences Iain Wright; assistant director general Shirley Tarawali and BecA-ILRI Hub director Appolinaire Djikeng



BecA-ILRI Hub **institutional landscape** study

In 2015, the Advisory Panel recommended a landscape assessment of providers of bioscience application support in the region to help establish the comparative advantage of the BecA-ILRI Hub. The study, which was finalized during the first quarter of 2016, explored the value proposition of the BecA-ILRI Hub and possible ways to improve its service offering, especially those not offered by other organizations.

The study, carried out jointly with CSIRO, identified the key themes of interest to stakeholders—partnership patterns and processes; constraints to or enablers of informed policy dialogue; skills and capability requirements in the region; institutional challenges in regional practices; and tensions between bioscience and development objectives.

A major finding was that despite a strong demand for the bioscience facilities and capabilities offered by the BecA-ILRI Hub, its role and services are not well understood. It also emerged that there was a growing presence of private sector initiatives with which there was a potential for synergies

to facilitate taking bioscience solutions to scale, generating impact across the region.

The study made three recommendations:

- i) Establish a mechanism for NARS and policymakers across the region to share and discuss research priority;
- ii) Support NARS to better prioritize applications to the ABCF, ensuring that the proposed fellows have the necessary institutional leverage to share the new capabilities and skills acquired through the fellowships with others upon their return home;
- iii) Promote the benefits and impacts of bioscience research to NARS, governments and donor agencies, encouraging greater prioritization of funding for bioscience technologies and services within national agricultural research programs.

The study confirmed the foundational logic of the BecA-ILRI Hub as an important, regionally valued bioscience facility. Findings from this study will guide future planning and provide useful lessons for bioscience practice and policy in the region.

Helen Butungi of ICIPE (Uganda), Doreen Marenju of NaCRRI, Paul Kuria of KALRO, Sarah Tojo of FOFIFA Madagascar and Fred Masika of Uganda Christian University during the annual Advanced Genomics and Bioinformatics workshop

New grants received in support of research and capacity development activities

The **European Commission** awarded a four-year grant of USD 5.4 million to ‘Innovations in technology, institutional and extension approaches towards sustainable agriculture and enhanced food and nutritional security in Africa (InnovAfrica)’ study under the Horizon 2020—Research and Innovation Framework Program. This is a collaborative research project bringing together the BecA-ILRI Hub, the Norwegian Institute of Bioeconomy Research (NIBIO), CIMMYT and 13 other institutions from sub-Saharan Africa and Europe, to improve food and nutritional security in Africa by (i) integrating sustainable agriculture intensification systems, and innovative institutional approaches with novel extension and advisory services, and (ii) enhancing capacity building and knowledge sharing in smallholder farming in sub-Saharan Africa (SSA).

A USD 30,000 grant from the **International Development Research Centre (IDRC)** supported the hosting of an international symposium on caviar in Cameroon. The symposium created an opportunity for south-south learning and collaboration amongst South American and African scientists and other actors in the caviar value chain. An earlier Australian funded research led by the BecA-ILRI Hub and CSIRO in collaboration with national partners University of Dschang in Cameroon and Université Evangélique en Afrique in DRC confirmed the potential contribution of caviar production as a stepping-stone for smallholder farmers to generate income, build assets and eventually own and manage other large livestock. The IDRC-funded symposium facilitated the establishment of networks to translate lessons learned on caviar farming from South America—where caviar research and husbandry spans over 50 years—to the African context.

The **BMGF** awarded USD 350,000 for two years as a supplement to an original investment—Program for Emerging Agricultural Research Leaders (PEARL)—that is co-funded by DFID. The program support grant provides NARS scientists with the means of driving discovery and applied research to address key constraints in crop and livestock production

for smallholder farmers in Africa. Through the supplemental grant, NARS scientists have access to enhanced support from international experts and institutions in addition to the BecA-ILRI Hub.

With AUD 9,900 from **ACIAR**, four crop breeders under the Demand-led Varietal Development Initiative were supported in attending the annual Advanced Genomics and Bioinformatics Training Workshop. The workshop strengthens the capacity of NARS researchers to apply genomics and bioinformatics in research in addressing demand-led research challenges.

The BecA-ILRI Hub was designated as the bioinformatics training centre under the **Wellcome Trust funded Afrique One-ASPIRE program**.

As such the BecA-ILRI Hub received a grant of EUR 389,845 to be used over a period of five years. The grant co-funds a scientist who oversees the training and mentorship of postgraduate students from the Afrique One-ASPIRE consortium on bioinformatics and supports access to the ABCF program by the consortium.

As part of a four-year grant of USD 1.2 million from **DTRA**, the BecA-ILRI Hub received USD 315,000 to support the genome sequencing of the African swine fever virus. **The work to be conducted over 12 months will underpin control strategies including improved diagnostics and surveillance.** The results of this research: support future vaccine development; allow prediction of the effectiveness of modified viruses for regional disease control as live vaccines in specific areas of Africa; enable the tracing of the origin and spread of new ASF outbreaks both within the African continent and globally; and enhance understanding of the host and vector-virus interaction, viral virulence factors, virus evolution and diversity in the context of the geographical distribution. This research builds on an earlier study of ASF funded by the Australian government and conducted by the BecA-ILRI Hub in partnership with CSIRO and national partners from Kenya and Uganda departments of veterinary services.

Pooling capacities for increased impact

36

Exploring opportunities for **Africa-Japan** research for development partnerships

The BecA-ILRI Hub and the Japan Society for the Promotion of Science (JSPS) organized a symposium to catalyse partnerships between African NARS and ILRI scientists. The symposium drew scientists from the Research Institute for Humanity and Nature (RIHN) and Hiroshima University and explored opportunities for collaborations in research, capacity development and technology transfer that will support smallholder farmers on the continent. Presentations made during the symposium included a highlight on JSPS involvement in research for development by Mizoguchi Daisuke, director of JSPS Nairobi Station and an overview of ILRI's research programs by assistant director general Shirley Tarawali.

Research project presentations included Shun Ishiyama from RIHN, Kyoto on support to communities in Burkina Faso in adapting to extreme weather; Ueru Tanaka from RIHN, Kyoto

on developing "Great Green Wall Initiatives" to control desertification and improve livelihoods in semi-arid Africa; Sita Ghimire and Josiah Mutuku from the BecA-ILRI Hub on crop improvement strategies, investigations on the use of on climate smart Brachiaria grass as an alternative forage for Africa and the development of a toolbox for managing viral diseases in common beans; and Vish Nene from ILRI on livestock vaccines research.

Following the successful symposium, the BecA-ILRI Hub director, Appolinaire Djikeng, Roger Pelle, principal scientist, and postdoctoral scientist Josiah Mutuku, were invited to attend a high-level event marking 50 years of Japan's contribution to science and technology in Africa. The event was a forerunner to the Sixth Tokyo International Conference on African Development (TICAD VI), the first ever TICAD summit to be held in Africa.

37

The BecA-ILRI Hub and JSPS organized a symposium to catalyse partnerships between Japanese scientists, African NARS and CG centres working in Africa.





38

Increasing cavy meat consumption in Africa

The BecA-ILRI Hub convened an international symposium in Yaoundé, Cameroon for over 30 participants from 13 countries from across Africa, Australia, Europe and South America, to discuss the untapped potential of domestic cavy in helping vulnerable households in Africa climb up the livestock ladder out of poverty.

For the first time in history, guinea pig production experts in Africa tapped directly into over 50 years' worth of research and practice from South America—where over 65 million guinea pigs are consumed each year—to strategize on how get more of these animals on African plates. The highlight of the symposium was a presentation by Lilia Chauca, a cavy expert from the National Agricultural Innovation Institute (INIA) in Peru, whose years of experience overseeing research has helped move cavy farming in the country from a subsistence to large-scale activity that has generated jobs for thousands of rural families.

First domesticated in South America, cavy seem to have adapted to lower altitudes and more humid environments in sub-Saharan Africa through natural selection and are distributed more widely across the continent than is currently recognized.

Cavies in Africa

- Up to 200,000 households in Cameroon and over 100,000 households in South Kivu Province in the Democratic Republic of Congo keep cavies.
- Research findings show high potential for livelihood improvement among smallholders through cavy-rearing—increased cavy meat consumption addresses low protein intake; cavy manure contributes to soil fertility and sale of both live animals and meat improves incomes. It was further shown that cavy-keeping is dominated by women (> 60%) and youth (>12%) in both countries
- Cavy technology developed in South America, which produces animals with an average weight of nearly 2kg (the size of a small rabbit), compared to 500gms in Africa, can be transferred and adapted to quickly address the challenges of poor animal husbandry and low productivity found in the family-based production systems in Africa.

Although this area of livestock farming is just emerging in Africa, the consumption of cavy meat, which is high in protein and low in fat, is widespread including in restaurants and urban markets in Cameroon and the DRC. The absence of cultural or religious inhibitions to cavy meat consumption means there is significant potential to improve nutrition and livelihoods.

Strengthening plant research capabilities

The BecA-ILRI Hub and Queensland University of Technology formed a strategic partnership to strengthen plant science research programs in both institutions to address food and nutritional security of African smallholder farmers. Inter-institutional exchange visits by faculty members, joint

supervision of ABCF fellows, co-hosting scientific meetings and joint resource mobilization are the major ongoing activities under this partnership.

Connecting advanced research institutions to the region

The declaration of JIC as winner of the BBSRC's Excellence with Impact (EWI) award in May 2016 was a cause for celebration at the BecA-ILRI Hub. The prize money of GBP 500,000 has been earmarked to support ongoing activities of the JIC-BecA-ILRI Hub alliance.

The support by Peter Emmrich, JIC senior PhD student, to Alemu Abate, an ABCF research fellow and grass pea breeder from Ethiopia, was showcased as a demonstration of research for impact under the BecA-ILRI Hub partnership. Emmrich's support to Alemu included the introduction of a technique for measuring ODAP toxin levels in grass pea.

Grass pea is drought hardy and can survive in the harsh farming conditions of arid areas. But the grain produces a toxin, beta-ODAP, which can cause spastic paralysis of the legs, a condition known as neurolathyrism. During his time at the BecA-ILRI Hub, Alemu identified 11 accessions with reduced ODAP levels that will be further tested in the field in Ethiopia.

Joint delegations from JIC and the BecA-ILRI Hub visited seven national institutions across eastern Africa to explore potential future collaborations. From these visits, several targeted activities are planned for 2017 including a joint NM-AIST-BecA-ILRI Hub-JIC short course on plant metabolism for improved nutrition and health.

Communicating research with a wider community

Communicating research findings to the public is increasingly becoming a necessary part of working as a scientist. To enable its scientists to do this more effectively, the BecA-ILRI Hub partnered with ISAAA AfriCentre, which focuses on communication and knowledge sharing, to deliver an intensive science communication course.

Researchers from KALRO working on the Virus Resistant Cassava for Africa (VIRCA) project joined scientists from the BecA-ILRI Hub for the training. The course familiarized them with various strategies for engaging policymakers, the media and the public at large. They also learned how to identify their audiences and develop audience-specific messages.

39



Participants of the international cavy symposium held in Yaounde, Cameroon

Raising the profile of the bioscience research centre for excellence

Showcasing BecA-ILRI Hub's continental role and international reach

During two key continental fora on agriculture in 2016, the BecA-ILRI Hub contributed to critical discussions on the vision for African agricultural development. Appolinaire Djikeng, the director of the BecA-ILRI Hub, gave a keynote speech on trans-boundary pooling of resources for research and development at the AASW7 and FARA general assemblies in Kigali, Rwanda.

Also at the AASW, a partnership catalysed by the BecA-ILRI Hub's research on aflatoxin to improve testing for the toxins in maize flour featured in a side event. The partnership, which brings together the Kenya Cereal Millers Association and the Texas

A&M AgriLife laboratory, has enabled the millers to accurately perform their own tests for aflatoxins in maize flour, reducing aflatoxin risk and improving food safety for an estimated 16 million Kenyans. Paloma Fernandes, chief executive of the Kenya Cereal Millers Association, gave a presentation on industry-led approaches to controlling aflatoxin in the country's food supply chain.

At a side event of the annual African Green Revolution Forum (AGRF), the BecA-ILRI Hub was commended as an accelerator for research taking place in NARS across Africa. The ABCF fellowship program, which has seen scientists contribute to national agricultural policies, spearhead seminal investigations and receive grants to expand their research, was praised as an innovative approach for building research leadership within national agricultural systems.

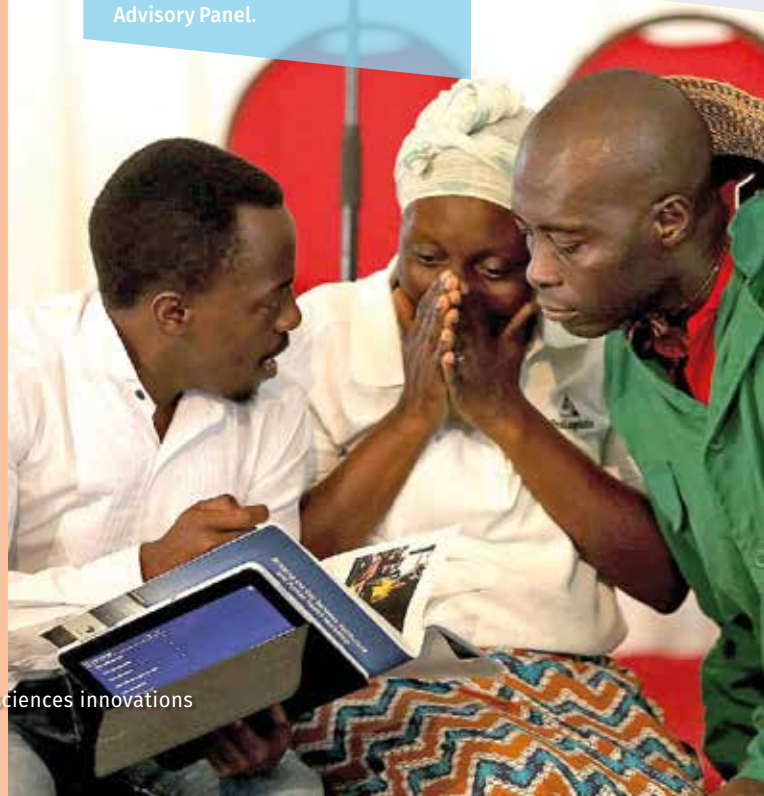
40

Dramatizing BecA-ILRI Hub's contribution to agricultural research in Africa

Originally developed for presentation during ILRI's Institutional Planning Meeting (IPM), a skit about the BecA-ILRI Hub by the ABCF fellows, partners and staff was performed for a number of other audiences, including the ILRI Board of Trustees and the BecA-ILRI Hub Advisory Panel.

The dramatization of the BecA-ILRI Hub's contribution to the continental agricultural research agenda sheds light on the Hub's critical role in bridging high-end research with practical solutions for smallholder farmers. This includes through its contribution: to increased research capabilities of NARS researchers and institutions; linking international institutions to national programs; and hosting other CGIAR centres and their partners in various technology platforms.

A skit about the BecA-ILRI Hub performed by ABCF fellows, partners and staff performed for various audiences including the ILRI Board of Trustees and the BecA-ILRI Hub Advisory Panel.



As part of the ILRI Institute Planning Meeting (IPM) to discuss strategies for contributing to better lives through livestock worldwide, the BecA-ILRI Hub gave an overview of its contribution to livestock, feed and forage research in Africa. Technology manager Josephine Birungi highlighted the world-class facilities available, terming mentorship of African scientists in the application of biosciences to their research as a key driver of the BecA-ILRI Hub. Wellington Ekaya who oversees the ABCF program gave a presentation on the BecA-ILRI Hub's

The biggest success from the soccer tournament is the coming together of the entire ILRI community to play and make friends. We will celebrate this for years!

Wellington Ekaya, *team manager*

strategy to grow science leadership in the NARS, as well as foster regional connections leveraging human and institutional resources across countries for joint action.



Teamwork and diversity earn BecA-ILRI Hub football trophy

By **David Baraza**, *program assistant, BecA-ILRI Hub*

Despite entering the ILRI annual football tournament as underdogs, the BecA-ILRI Hub football team were crowned 2016 champions.

Every year, the ILRI football tournament is organized to run for 40 days, a period in which teamwork and strategy are applied beyond research, in the spirit of learning through fun.

The BecA-ILRI Hub team reflected the principle of a 'shared platform' and comprised players from BecA staff, ABCF fellows and other ILRI departments.

I was honoured to captain a team that drew its strength from diversity, with players from Benin, Nigeria, Cameroon, Uganda and Kenya. My team's



BecA-ILRI Hub football team captain David Barasa receives winners' trophy from ILRI director general Jimmy Smith

impenetrable defence provided by Jean Phillipe (Cameroon) and Isidore Houaga (Benin); tactical advice from the team coaches Martin Mwirigi (Kenya) and Fred Masika (Uganda); able management by BecA-ILRI Hub capacity building senior scientist Wellington Ekaya; motivation by director Appolinaire Djikeng; and support from our fans all contributed to our overall success.

In 2016, the BecA-ILRI Hub's key activities featured extensively in regional and international media through news articles and feature stories. Following the BecA@15 celebration in February, which was attended by various regional and international dignitaries, the Hub's work received wide coverage including the following mentions:

- Nairobi bioscience hub takes Africa to the next scientific frontier: bit.ly/BecA15Star
- Biosciences key to solving agricultural challenges: bit.ly/BecA15Afronline
- Agriculture CS urged to base policy on new tech: bit.ly/BecA15Nation
- Communication vital for Africa to achieve the SDGs: bit.ly/BecA15ScieDev
- Kenya's Agriculture Minister and AU-NEPAD CEO Underscores Use of ST&I in African Agriculture: bit.ly/BecA15Cropbiotech
- Biosciences key to solving agricultural challenges: bit.ly/BecA15SciDev2

In an article co-authored by Sue Desmond-Hellmann, BMGF CEO and Nick Hurd, international development minister for DFID, UK and published after the signing of a MoU renewing the BMGF-DFID partnership to end extreme poverty, the BecA-ILRI Hub was recognized as a strategic investment that is fuelling development through increased scientific knowledge in Africa: bit.ly/GuardianR4D

In an article co-authored by BMGF and DFID, the BecA-ILRI Hub was recognized as a strategic investment that is fuelling development through increased scientific knowledge in Africa.

The BecA-ILRI Hub received extensive coverage in the context of the FARA's Seventh African Agricultural Science Week (AASW7) through video blogs and articles published on the official AASW7 website:

- Vlog interview with the BecA-ILRI Hub director: bit.ly/AASW7Appolinaire
- Vlog interview with the head of the ABCF program: bit.ly/AASW7Ekaya
- Article on capacity development mentions BecA-ILRI Hub: bit.ly/AASW7Capacity
- Article on CIP's Food and Nutritional Evaluation Laboratory mentions the BecA-ILRI Hub: bit.ly/ASSW7CIP

Also in the context of the AASW7, CGIAR hosted a series of live interviews which included one by the BecA-ILRI Hub director on the role of African scientists in national agricultural research systems and universities: bit.ly/ASSW7CGInterview

Following their successful bid for the Excellence with Impact award, the John Innes Centre highlighted the alliance with the BecA-ILRI Hub on their website: bit.ly/JICAward

The international caviary symposium convened in Yaoundé resulted in coverage on Cameroonian national TV and print media

- National broadcaster Cameroon Radio TV aired a news report on the symposium: bit.ly/CrTVCavies
- On 9 August the Cameroon Tribune carried a story on the potential of domestic cavy as livestock 'Cameroon's potential underexploited' and a profile of key partner of the BecA-ILRI Hub, Ursule Mekongo Fonbod—'Une vie de cobaye' (A life of caviary)

Following a visit to the BecA-ILRI Hub by a delegation from the Canadian Food Grain Bank an article on research at the BecA-ILRI Hub was carried in the online magazine Hilltimes highlighting research and technologies at the BecA-ILRI Hub:

bit.ly/BecAHilltimes and on the FoodGrains Bank website: bit.ly/BecAFoodGrains

The North Carolina State University highlighted their partnership with the BecA-ILRI Hub on receiving a grant to boost an existing research collaboration:

bit.ly/NCSUGates

The launch of the IGSS platform in November 2016 attracted coverage from local and international media outlets:

- bit.ly/IGSSXinhua
- on.china.cn/2p2Kasr
- bit.ly/IGSSNamibiaPress
- bit.ly/IGSSCoastWeek
- bit.ly/IGSSTheStar
- bit.ly/IGSSChinaNews

Staff, partners and ABCF fellows celebrate the BecA-ILRI Hub's 15th anniversary



The BecA-ILRI Hub received extensive coverage in the context of FARA's Seventh African Agricultural Science Week (AASW7) through video blogs and articles published on the official AASW7 website.

Quick access to BecA-ILRI Hub publications

BecA-ILRI Hub prospectus: bit.ly/BecAProspectus

ABCF program prospectus: bit.ly/ABCFFProspectus

The BecA-ILRI Hub in the region brochures:

- Cameroon: bit.ly/BecACameroun
- Eritrea: bit.ly/BecAEritrea
- Ethiopia: bit.ly/BecAEthiopia
- Kenya: bit.ly/BecAKenya
- Rwanda: bit.ly/BecARwanda
- Tanzania: bit.ly/BecATanzania
- Uganda: bit.ly/BecAUganda

Capacity to support research in Africa

44



Boniface Muganda is a system and database administrator for the IGSS platform. He works in collaboration with the Diversity Arrays Technology (DART) Pty Ltd, IT team to establish and maintain the ICT infrastructure of the IGSS platform. He also offers bioinformatics support to scientists and breeders.



Denis Mwangi is a research associate on the IGSS platform. He is part of the team responsible for providing genotypic and informatics support services to crop and livestock improvement programs in Africa.

Leonard Kiche is a research associate focusing on system and database administration for the IGSS platform. Kiche works in collaboration with the DART Pty Ltd. Australia team to establish and maintain the IT infrastructure of the IGSS platform. He is also involved in running the IGSS platform and genomic data analysis.



Martin Kanyeke is a research associate at the IGSS platform. He provides genotyping and sample shipment support to clients including technical advice on sample collection, storage, DNA extraction and shipment of the DNA samples to the BecA-ILRI Hub. He also provides decision support to IGSS clients to increase the efficiency of breeding programs.



Phillis Ochieng is a research associate at the BecA-ILRI Hub where she provides support to research fellows and scientists working on the mycotoxin diagnostics and nutritional analysis platform. Specifically, she supports research analyses using association of analytical communities (AOAC) methods.



Samuel Ng'ang'a works as a research associate on the IGSS platform. As a trained laboratory technician in DARTseq Genotyping his main role is DNA extraction, DNA sequencing and quality control of these services. He is also involved in data analysis and generating reports for clients of the IGSS platform.

Growing roles for team members in 2016



Vincent Njung'e is a research associate involved in capacity building and training of research fellows at the BecA-ILRI Hub. He provides high level, comprehensive technical support and bench supervision to scientists and research fellows working in crop and livestock-related research projects.



Fredrick Ng'ang'a is a research associate-analytical chemist on the mycotoxin diagnostics and nutritional analysis platform. He offers technical support to visiting and hosted scientists in the screening and quantification of various mycotoxins in food and feed stuff through ELISA, fluorometry and Liquid chromatography-Mass Spectrometry in addition to profiling various bio-active ingredients in food.

Sita Ghimire was appointed senior editor for *Phytobiomes*, a journal of the American Phytopathological Society. *Phytobiomes* is an open access interdisciplinary journal on sustainable plant productivity that publishes original research on organisms and communities interacting with plants in different ecosystems. It publishes fundamental translational work in microbiology, plant pathology, entomology, agronomy, ecology, nutrient cycling, climate change and computational biology.

Wellington Ekaya was appointed to the board committee on communications and policy for the Afrique One-ASPIRE. This is a pan-African alliance established to equip African scientists with expertise in planning, monitoring and evaluating interventions of One Health research with the aim of tackling zoonoses. Ekaya is also the coordinator for all Afrique One-ASPIRE activities carried out at the BecA-ILRI Hub, which is the consortium's high-end bioscience training hub.

45



Wellington Ekaya (right) and Valerian Aloo (2nd right) attend the launch of Afrique One-ASPIRE in Kampala, Uganda

Staff in 2016

SCIENTISTS

Appolinaire Djikeng, Director
Clay Sneller, Lead plant breeder
Francesca Stomeo, Capacity building
Jagger Harvey, Plant molecular biologist*
Josephine Birungi, Technology manager
Nasser Yao, Plant molecular breeder
Roger Pelle, Molecular parasitologist
Sita Ghimire, Plant pathologist
Wellington Ekaya, Head of the ABCF program

POST-DOCTORAL SCIENTISTS

Josiah Mutuku, Plant pathologist

VISITING SCIENTISTS

Samuel Mutiga, Plant pathologist
Tilly Eldridge, Plant geneticist

RESEARCH ASSOCIATES

Ben Kiawa, Unit coordinator, Sequencing, Genotyping, OligoSynthesis and Proteomics (SegoliP) unit
Boniface Muganda, Integrated Genotyping Service and Support (IGSS) platform
Collins Mutai, Brachiaria project
Denis Mwangi, IGSS platform
Dedan Githae, Bioinformatician
Eunice Machuka, Capacity building
Frederick Ng'ang'a, mycotoxin diagnostics and nutritional analysis
Immaculate Wanjuki, Aflatoxin project*
Joyce Nzioki, Bioinformatician
Leah Kago, Brachiaria project
Leonard Kiche, IGSS platform
Lucy Muthui, SegoliP unit

Martina Kyalo, Capacity building
Martin Kanyeki, IGSS platform
Pauline Asami, Plant tissue culture and transformation**
Phillis Ochieng, Mycotoxin diagnostics and nutritional analysis
Samuel Ng'ang'a, IGSS platform
Vincent Njung'e, Capacity building

TECHNICAL SUPPORT

Agnes Mburu, Technical management assistant
Dalmas Ngere, Laboratory assistant
Edwin Onyiego, Greenhouse assistant
Everlyn Onyango, Technical assistant, Central Core
Francis Gatehi, Laboratory assistant
Julius Osaso, Diagnostic platform manager
Linnet Agiza, Laboratory assistant
Manasses Mwaura, Technical assistant, Central Core
Mary Odiyo, Laboratory assistant
Mary Wambugu, Technical support coordinator, Integrated Breeding Platform
Michael Ominde, General laboratory assistant
Winnie Muoka, Laboratory assistant

PROGRAM SUPPORT

David Barasa, Program assistant
Edith Ng'ang'a, Project accountant
Ethel Makila, Communications officer
Helen Altshul, Development partnerships specialist
Leah Ndungu, Program coordinator
Marvin Wasonga, Administrative assistant, capacity building*
Monicah Njuguna, Laboratory procurement assistant
Rachael Mwangi, Program management officer
Valerian Aloo, Capacity building officer

*Left the BecA-ILRI Hub in 2016 **Left for further studies in 2016

African national agricultural research systems **research fellows**

BENIN

Isidore Houaga, Technical College of Abomey Calavi/ JKUAT, researcher. *Research focus: Polymorphisms of major milk protein genes, DGAT1 and SCD1 genes and association with milk traits in indigenous Bos indicus (Gudali and White Fulani) and Bos taurus (Borgou and Lagune) cattle breeds in Benin.*

BURUNDI

Gaspard Nihorimbere, Institut des Sciences Agronomique du Burundi (ISABU), researcher. *Research focus: Molecular characterization of sweet potato landraces and cultivars grown in Burundi.*

CAMEROON

Christian Keambou, University of Buea, senior lecturer. *Research focus: Investigating the expression profile of growth, reproduction and immune related genes in local chicken under natural growth promoters and organic feeding.*

Jean Phillipe Kazi, National Veterinary Laboratory (LANAVET), researcher. *Research focus: Molecular epidemiology of Peste des petits ruminants (PPR) virus in Cameroon.*

Aissatou Diddi, (LANAVET), researcher. *Research focus: Molecular epidemiology of PPR virus in Cameroon.*

Judith Makombu, University of Buea, lecturer. *Research focus: Morphological and molecular identification of fresh water prawn of genus Macrobrachium in south region of Cameroon.*

DRC

Patrick Bisimwa, Evangelical University, researcher/ lecturer. *Research focus: molecular characterization of African swine fever in South Kivu Province of DRC.*

Gaston Amzati, Evangelical University, researcher/ lecturer. *Research focus: Eco-Epidemiology of East Coast fever: cross-sectional, longitudinal and genetics studies of Rhipicephalus appendiculatus and Theileria parva in eastern Congo, Rwanda and Burundi.*

Rodrigue Ayagirwe, Evangelical University, researcher/lecturer. *Research focus: Single nucleotide polymorphism discovery and validation in Solanum aethiopicum.*

ETHIOPIA

Getinet Mekuriaw, Bahir Dar University, researcher. *Research focus: Understanding the genetic diversity and demographic dynamics of African indigenous goats through maternal DNA, and genome-wide linkage disequilibrium and selection signature analyses.*

Adebabay Kebede, Ethiopian Institute of Agricultural Research, researcher. *Research focus: Assessment of genetic diversity of indigenous chicken populations in north-western Ethiopia.*

KENYA

Josephine S. Kunguni, KALRO, researcher. *Research focus: Characterization of Eleusine species for response to Striga.*

Joshua Amimo, University of Nairobi, researcher/ lecturer. *Research focus: Molecular epidemiology of selected enteric viruses in swine in East Africa region.*

Martin Mwirigi, KALRO, researcher. *Research focus: Development of improved diagnostics for Capripoxvirus infections.*

Benjamin Kivuva, KALRO, researcher. *Research focus: Fingerprinting of sweet potato (Ipomea Batatas) landraces in Kenya.*

Isaac Njaci, Kenyatta University, researcher. *Research focus: Enhancing Kenyan pigeonpea industry through delivery of suitable varieties with pod borer (Helicoverpa armigera) resistance.*

Pascal Okwiri, Egerton University, researcher/lecturer. *Research focus: Genome-wide association analyses of common bean (*Phaseolus vulgaris* L.) for resistance to bean fly (*Ophiomyia* spp) for enhanced production in marginal environments.*

Joel Khobondo, Egerton University, researcher/lecturer. *Research focus: Influence of indigenous chicken genotype on metagenomic of gut Microbiota: comparative analysis and functional inference.*

Hassan Were, Masinde Muliro University of Science and Technology, researcher/professor. *Research focus: Occurrence, distribution, and molecular diversity of virus stressors on grain legumes in western Kenya.*

Annie Njoroge, International Potato Center, researcher. *Research focus: How population dynamics and pathogen evolution of *Phytophthora infestans* affects epidemiology and management of late blight disease in East Africa.*

Moses Orwe, KALRO, researcher. *Research focus: Identification and expression of priority vaccine antigen homologues of *Mycoplasma mycoides* in *Mycoplasma capricolum capripneumoniae*.*

Fatuma Mzingirwa, Kenya Marine and Fisheries Research Institute, researcher. *Research focus: Connectivity of the mangrove red snapper, *Lutjanus argentimaculatus* (Pisces: Lutjanidae) populations in marine-protected areas (MPAs) and the adjacent open fishing zones on the Kenyan coast.*

Daniel Mutisya, KALRO, scientist. *Research focus: Molecular identification of red spider mites on *Brachiaria* grass in Kenya.*

MADAGASCAR

Claudine Razanaboahirana, The National Centre for Applied Research on Rural Development (FOFIFA), researcher. *Research focus: Molecular characterization of popular red rice (*Oryza sativa*) cultivated in Madagascar and its improvement.*

NIGERIA

Ronke Yemisi, Federal University of Agriculture–Abeokuta, senior lecturer/researcher. *Research focus: Rumen manipulation using plant extract for improved nutrient utilization in ruminants.*

Blessing Adanta, Makerere University/University of Port Harcourt, researcher/lecturer. *Research focus: Resistance to common bean rust (*Uromyces appendiculatus* Pers) Unger in Uganda.*

Popoola Moshood, Federal College of Animal Health and Production Technology, researcher. *Research focus: Genetics, morphometric and agonistic descriptions for indigenous ram breeds in Nigeria.*

Oluwafunmilayo Adeleye, University of Ibadan, lecturer/researcher. *Research focus: Influence of extrudates of grain legumes on enzymatic activity, nutrient digestibility, gastrointestinal conditions and microbial community of broiler chicks.*

SOUTH SUDAN

Morris Juma, National Ministry of Agriculture, Forestry, Cooperative and Rural Development, researcher. *Research focus: Assessment of the extent of Aflatoxin contamination in peanut: inferences from farm and market surveys in South Sudan.*

Richard Zozimo, Agricultural Research Corporation, researcher. *Research focus: Genetic diversity and nutritional composition of sorghum land rice accessions in South Sudan.*

Maurice Mogga, National Ministry of Agriculture, South Sudan, researcher. *Research focus: Genetic improvement of yield and grain quality in Upland rice (*Oryza sativa* L.) in South Sudan.*

SUDAN

Yassir Hassan, Animal Production Research Centre, researcher. *Research focus: Assessment of variability among striga hermonthica population in Sudan using simple sequence repeat (SSR) markers.*

Babiker Eshag, Agricultural Research Corporation, researcher. *Research focus: Assessment of variability among striga hermonthica populations in Sudan using SSR markers.*

TANZANIA

Pius Lazaro, Tanzania Livestock Research Institute (TALIRI), researcher. *Research focus: Genetic diversity and conservation strategies for productivity improvement and sustainable utilization of the highly-adapted Tanzania native chicken ecotypes.*

Miccah Seth, Mikocheni Agricultural Research Institute, researcher. *Research focus: Screening local germplasm of mung bean for inducing suicidal Striga hermonthica seed germination.*

UGANDA

Victoria Tibenda, Aquaculture Research and Development Centre, researcher. *Research focus: Prevalence of mycotoxin and associated fungi in commercial fish feed and farmed fish in the Lake Victoria basin.*

Ronald Kakeeto, National Agricultural Research Organisation (NARO), researcher. *Research focus: Comparison of single nucleotide polymorphisms and simple sequence repeat diversity indices in a set of groundnut collections from Uganda.*

Fred Masika, Uganda Christian University, researcher/lecturer. *Research focus: Exploitation of host diversity for improved finger millet blast disease management in Uganda.*

Tonny Obua, Makerere University, researcher/lecturer. *Research focus: Genetic improvement of oil quality and yield of soybean in Uganda.*

Kennedy Odokonyero, International Center for Tropical Agriculture (CIAT), researcher. *Research focus: Use of green fluorescent protein (gfp) to elucidate fungal endophyte distribution and abundance in Brachiaria grass.*

Geoffrey Kawube, Gulu University, researcher/lecturer. *Research focus: Exploitation of host diversity for improved finger millet blast disease management in Uganda.*

Tonny Obua, ABCF fellow and researcher from Makerere University (left) examines soybean plants on a farm in Uganda



Scientific publications

Amimo, J.O., El Zowalaty, M.E., Githae, D., Wamalwa, M., Djikeng, A. and Nasrallah, G.K. 2016. Metagenomic analysis demonstrates the diversity of the fecal virome in asymptomatic pigs in East Africa. *Archives of Virology* 161(4):887–897.

Barasa, J.E., Abila, R., Grobler, J.P., Agaba, M., Chemoiwa, E.J. and Kaunda-Arara, B. 2016. High genetic diversity and population differentiation in *Clarias gariepinus* of Yala Swamp: Evidence from mitochondrial DNA sequences. *Journal of Fish Biology* 9 (6):2557–2570.

Dinga, J.N., Njimoh, D.L., Kiawa, B., Djikeng, A., Nyasa, R.B., Nkuo-Akenji, T., Pellé, R. and Titanji, V.P.K. 2016. Differential T-cell responses to a chimeric *Plasmodium falciparum* antigen; UB05-09, correlates with acquired immunity to malaria. *Parasite Immunology* 38(5):303–316.

Eldridge, T., Łangowski, Ł., Stacey, N., Jantzen, F., Moubayidin, L., Sicard, A., Southam, P., Kennaway, R., Lenhard, M., Coen, E.S. and Østergaard, L. 2016. Fruit shape diversity in the *Brassicaceae* is generated by varying patterns of anisotropy. *Development* 143(18): 3394–3406.

Ghebreslassie, B.M., Githiri, S.M., Mehari, T., Kasili, R.W., Ghislain, M. and Magembe, E. 2016. Genetic diversity assessment of farmers and improved potato (*Solanum tuberosum*) cultivars from Eritrea using simple sequence repeat (SSR) markers. *African Journal of Biotechnology* 15(35):1883–1891.

Ghebreslassie, B.M., Githiri, S.M., Tadesse, M. and Kasili, R.W. 2016. Morphological diversity of farmers' and improved potato (*Solanum tuberosum*) cultivars growing in Eritrea. *Journal of Plant Studies* 5(2):63.

Ghimire, S., Ahonsi, M. and Djikeng, A. 2016. Climate variability and extremes: Relevance of agroecological-based climate smart farming systems in the sub-Saharan Africa. IN: Nagothu, U.S. 2016. *Climate change and agricultural development: Improving resilience through climate smart agriculture, agroecology and conservation*. Oxon, UK: Routledge.

Gichangi, E.M., Njarui, D.M., Gatheru, M.J., Magiroi, K.W. and Ghimire, S.R. 2016. Effects of brachiaria grasses on soil microbial biomass carbon, nitrogen and phosphorus in soils of the semi-arid tropics of Kenya. *Tropical and Subtropical Agroecosystems* 19(2).

Hemmink, J.D., Weir, W., MacHugh, N.D., Graham, S.P., Patel, E., Paxton, E., Shiels, B., Toye, P.G., Morrison, W.I. and Pelle, R. 2016. Limited genetic and antigenic diversity within parasite isolates used in a live vaccine against *Theileria parva*. *International Journal for Parasitology* 46(8):495–506.

Kama-Kama, F., Midiwo, J., Nganga, J., Maina, N., Schiek, E., Omosa, L.K., Osanjo, G. and Naessens, J. 2016. Selected ethno-medicinal plants from Kenya with in vitro activity against major African livestock pathogens belonging to the 'Mycoplasma mycoides cluster'. *Journal of Ethnopharmacology* 192:524–534.

Kamau, E., Nyanjom, S.G. and Wamalwa, M. 2016. Prediction of protein–protein interactions between *Theileria parva* and *Bos taurus* based on sequence homology. *Bioscience Horizons* 9(hzw006).

Kanduma, E.G., Mwacharo, J.M., Githaka, N.W., Kinyanjui, P.W., Njuguna, J.N., Kamau, L.M., Kariuki, E., Mwaura, S., Skilton, R.A. and Bishop, R.P. 2016. Analyses of mitochondrial genes reveal two sympatric but genetically divergent lineages of *Rhipicephalus appendiculatus* in Kenya. *Parasites & Vectors* 9(1):353.

Kidanemariam, D.B., Abraham, A.D., Sukal, A.C., Holton, T.A., Dale, J.L., James, A.P. and Harding, R.M. 2016. Complete genome sequence of a novel *zantedeschia* mild mosaic virus isolate: The first report from Australia and from *Alocasia* sp. *Archives of Virology* 161(4):1079–1082.

Lichoti, J.K., Davies, J., Kitale, P.M., Githigia, S.M., Okoth, E., Maru, Y., Bukachi, S.A. and Bishop, R.P. 2016. Social network analysis provides insights into African swine fever epidemiology. *Preventive Veterinary Medicine* 126:1–10.

Marcellino, W.L., Salih, D.A., Njahira, M.N., Ndiwa, N., Araba, A., El Hussein, A.M., Seitzer, U., Ahmed, J.S., Bishop, R.P. and Skilton, R.A. 2016. The Emergence of *Theileria parva* in Jonglei State, South Sudan: Confirmation using molecular and serological diagnostic tools. *Transboundary and Emerging Diseases* 1865–1682.

Mekuriaw, G., Gizaw, S., Dessie, T., Mwai, O., Djikeng, A. and Tesfaye, K. 2016. A review on current knowledge of genetic diversity of domestic goats (*Capra hircus*) identified by microsatellite loci: How those efforts are strong to support the breeding programs? *Journal of Life Science and Biomedicine* 6(2):22–32.



Moges, A.D., Admassu, B., Belew, D., Yesuf, M., Njuguna, J., Kyalo, M. and Ghimire, S.R. 2016. Development of microsatellite markers and analysis of genetic diversity and population structure of *Colletotrichum gloeosporioides* from Ethiopia. *PLoS One* 11(3):e0151257.

Munguti, F.M., Kilalo, D.C., Macharia, M.W., Magiri, E.N., Kinyua, J.K. and Holton, T.A. 2016. Evaluation of *Passiflora edulis* leaf sample storage methods on RNA quality and suitability for use in RT-PCR assays. *Annual Research & Review in Biology* 10(1).

Mwaikono, K.S., Maina, S., Sebastian, A., Schilling, M., Kapur, V. and Gwakisa, P. 2016. High-throughput sequencing of 16S rRNA gene reveals substantial bacterial diversity on the municipal dumpsite. *BMC Microbiology* 16(1):145.

Nantima, N., Davies, J., Dione, M., Ocaido, M., Okoth, E., Mugisha, A. and Bishop, R. 2016. Enhancing knowledge and awareness of biosecurity practices for control of African swine fever among smallholder pig farmers in four districts along the Kenya–Uganda border. *Tropical Animal Health and Production* 48(4):727–734.

Nene, V., Kiara, H., Lacasta, A., Pelle, R., Svitek, N. and Steinaa, L. 2016. The biology of *Theileria parva* and control of East Coast fever—Current status and future trends. *Ticks and Tick-borne Diseases* 7(4):549–564.

Nishimwe, K., Wanjuki, I., Karangwa, C., Darnell, R. and Harvey, J. 2016. An initial characterization of aflatoxin B1 contamination of maize sold in the principal retail markets of Kigali, Rwanda. *Food Control* 73(B):574–580.

Omoga, D.C.A., Macharia, M., Magiri, E., Kinyua, J., Kasiiti, J. and Holton, T. 2016. Molecular based detection, validation of a LAMP assay and phylogenetic analysis of Capripoxvirus in Kenya. *Journal of Advances in Biology & Biotechnology* 7(3):1–12.

Onyango, B.O., Mbaluto, C.A., Mutuku, C.S. and Otieno, D.O. 2016. Molecular characterization of wood ear mushrooms (*Auricularia* sp) from Kakamega forest in western Kenya. *Current Research in Environmental & Applied Mycology* 6(1): 51–60.

Onyango, M.G., Aitken, N.C., Jack, C., Chuah, A., Oguya, J., Djikeng, A., Kemp, S., Bellis, G.A., Nicholas, A., Walker, P.J. and Duchemin, J.B. 2016. Genotyping of whole genome amplified reduced representation libraries reveals a cryptic population of *Culicoides brevitarsis* in the Northern Territory, Australia. *BMC Genomics* 17(1):769.

Rothen, J., Githaka, N., Kanduma, E.G., Olds, C., Pflüger, V., Mwaura, S., Bishop, R.P. and Daubenger, C. 2016. Matrix-assisted laser desorption/ionization time of flight mass spectrometry for comprehensive indexing of East African ixodid tick species. *Parasites & Vectors* 9(1):1.

Rukambile, E., Machuka, E., Njahira, M., Kyalo, M., Skilton, R., Mwega, E., Chota, A., Mathias, M., Sallu, R. and Salih, D. 2016. Population genetic analysis of *Theileria parva* isolated in cattle and buffaloes in Tanzania using minisatellite and microsatellite markers. *Veterinary Parasitology* 224:20–26.

Saleh, B.K., Kasili, R.W., Mamati, E.G., Yao, K.N., deVilliers, S.M., Araia, W. and Nyende, A.B. 2016. Genetic diversity and population structure of Eritrean pepper (*Capsicum* species) as revealed by SSR markers. *Molecular Plant Breeding* 7(09):1–16.

Sisay, Z., Djikeng, A., Berhe, N., Belay, G., Abegaz, W.E., Wang, Q.H. and Saif, L.J. 2016. First detection and molecular characterization of sapoviruses and noroviruses with zoonotic potential in swine in Ethiopia. *Archives of Virology* 161(10):2739–47.

Sisay, Z., Djikeng, A., Berhe, N., Belay, G., Gebreyes, W., Abegaz, W.E., Njahira, M.N., Wang, Q.H. and Saif, L.J. 2016. Prevalence and molecular characterization of human noroviruses and sapoviruses in Ethiopia. *Archives of Virology* 161(8):2169–82.

Tchinda, N.D., Wanjala, B.W., Muchugi, A., Fotso, F., Nzweundji, G., Ndoumou, D.O. and Skilton, R. 2016. Genetic diversity and gene flow revealed by microsatellite DNA markers in some accessions of African plum (*Dacryodes edulis*) in Cameroon. *African Journal of Biotechnology* 15(13):511–517.

Temba, B.A., Sultanbawa, Y., Kriticos, D.J., Fox, G.P., Harvey, J.J. and Fletcher, M.T. 2016. Tools for controlling a major global food and feed safety risk: Non-biological post-harvest procedures to decontaminate mycotoxins in food and feeds. *Journal of Agricultural and Food Chemistry* 64 (47): 8959–8972.

Tinega, G., Magiri, E., Kinyua, J., Njahira, M., Erume, J., Ejobi, F., Tegule, S. and Mutua, F. 2016. Characterization of *Salmonella* isolates obtained from pigs slaughtered at Wambizzi Abattoir in Kampala, Uganda. *Journal of Agriculture Science and Technology* 17(1):99–120.

Tretina, K., Pelle, R. and Silva, J.C., 2016. Cis regulatory motifs and antisense transcriptional control in the apicomplexan *Theileria parva*. *BMC Genomics* 17(1):1.

Wambua, L., Wambua, P.N., Ramogo, A.M., Mijele, D. and Otiende, M.Y. 2016. Wildebeest-associated malignant catarrhal fever: perspectives for integrated control of a lymphoproliferative disease of cattle in sub-Saharan Africa. *Archives of Virology* 161(1):1–10.

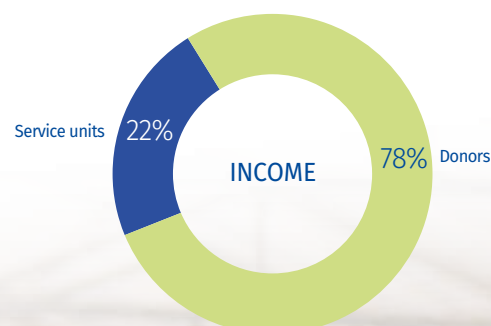
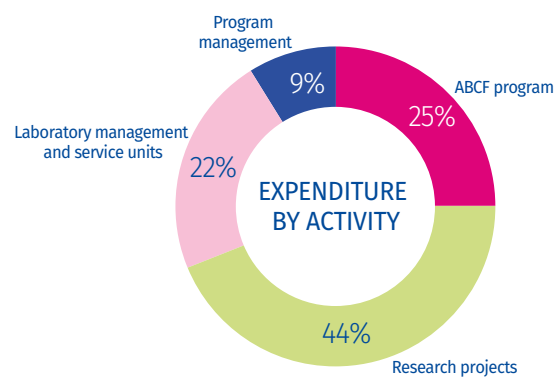
Yao, N., Lee, C.R., Semagn, K., Sow, M., Nwilene, F., Kolade, O., Bocco, R., Oyetunji, O., Mitchell-Olds, T. and Ndjondjop, M.N. 2016. QTL mapping in three rice populations uncovers major genomic regions associated with African rice gall midge resistance. *PLoS One* 11(8):e0160749.



Statement of **income** and **expenses** in 2016

Income	USD "000"	%
Donors	8,653	78
Service units	2,419	22
Total expenditure	11,071	100

Expenditure by Activity	USD "000"	%
ABCF program	2,781	25
Research projects	4,819	44
Laboratory management and service units	2,418	22
Program management	1,054	9
Total expenditure	11,071	100



Donors

The BecA-ILRI Hub relies largely on funding and grants from investors: building capacity for research in its five thematic research areas (food safety and nutrition; livestock productivity; crop improvement; climate change mitigation; underutilized species); acquiring and maintaining infrastructure and technology; and in supporting NARS to develop new bioscience programs or set-up laboratory infrastructure.

In 2016, cross-cutting ongoing support to the Hub was provided by the following donors:

- Australian government
- Australian Centre for International Agricultural Research
- Bill & Melinda Gates Foundation
- Biotechnology and Biological Sciences Research Council
- European Union
- International Development Research Centre
- Swedish International Development Cooperation Agency
- Syngenta Foundation for Sustainable Agriculture, Switzerland
- UK Department for International Development
- US Defense Threat Reduction Agency
- Wellcome Trust, UK.



Acronyms

AAS African Academy of Science	GMP Good manufacturing practices
AASW Africa Agriculture Science Week	GS Genomic selection
ABCF Africa Biosciences Challenge Fund	HACCP Hazard analysis and critical control point
ACIAR Australian Centre for International Agricultural Research	IBD Infectious bursal disease
AESA Alliance for Accelerating Excellence in Science in Africa	IFS International Foundation for Science
AGRF African Green Revolution Forum	IGSS Integrated Genotyping Service and Support
AR4D Agricultural research for development	IITA International Institute of Tropical Agriculture
ASPIRE African Science Partnership for Intervention Research Excellence	ILRI International Livestock Research Institute
AU African Union	INIA National Agricultural Innovation Institute
AU-IBAR African Union-Interafrican Bureau for Animal Resource	IPM Institute Planning Meeting
AVCD Accelerated Value Chain Development	ISAAA International Service for the Acquisition of Agri-biotech Applications
AWARD African Women in Agricultural Research and Development	JIC John Innes Centre
BBSRC Biotechnology and Biological Sciences Research Council	JKUAT Jomo Kenyatta University of Agriculture and Technology
Beca-ILRI Hub Biosciences eastern and central Africa -International Livestock Research Institute Hub	JSPS Japan Society for the Promotion of Science
BISPA Engineering Bureau of Animal Health and Production	KALRO Kenya Agricultural and Livestock Research Organization
BMGF Bill & Melinda Gates Foundation	LCGR4D Local Chicken Genetic Research for Development
CAAREA Capacity and Action for Aflatoxin Reduction in Eastern Africa	NARO National Agricultural Research Organization
CIAT International Center for Tropical Agriculture	NARS National agricultural research systems
CIMMYT International Maize and Wheat Improvement Center	NCSU North Carolina State University
CIP International Potato Center	NEPAD New Partnership for Africa's Development
CMD Cassava mosaic disease	NM-AIST Nelson Mandela African Institution of Science and Technology
CMV Cassava mosaic virus	NSF-PIRES National Science Foundation Partnerships for International Research and Education
CoP Community of practice	OFSP Orange-fleshed sweet potato
CSIRO Commonwealth Scientific and Industrial Research Organisation	QAAFI Queensland Alliance for Agriculture and Food Innovation
DarT Diversity Arrays Technology	RAB Rwanda Agriculture Board
DELTAS Developing Excellence in Leadership, Training and Science	RIHN Research Institute for Humanity and Nature
DFID UK Department for International Development	S3A Science Agenda for Agriculture in Africa
DRC Democratic Republic of the Congo	Sida Swedish International Cooperation Development Agency
DVS Directorate of Veterinary Services	SLU Swedish University of Agricultural Sciences
EWI Excellence with Impact	SSA Sub Saharan Africa
FANEL Food and Nutritional Evaluation Laboratory	TAAT Technologies for African Agricultural Transformation
FARA Forum for Agricultural Research in Africa	TICAD Tokyo International Conference on African Development
	USAID United States Agency for International Development
	VIRCA Virus Resistant Cassava for Africa

This publication is copyrighted by the Biosciences eastern and central Africa-International Livestock Research Institute Hub (BecA-ILRI) Hub. It is licensed for use under the Creative Commons Attribution 4.0 International Licence. To view this licence, visit <https://creativecommons.org/licenses/by/4.0>. Unless otherwise noted, you are free to share (copy and redistribute the material in any medium or format), adapt (remix, transform, and build upon the material) for any purpose, even commercially, under the following condition:

ATTRIBUTION. The work must be attributed, but not in any way that suggests endorsement by ILRI or the author(s).

NOTICE: For any reuse or distribution, the license terms of this work must be made clear to others. Any of the above conditions can be waived if permission is obtained from the copyright holder. Nothing in this license impairs or restricts the author's moral rights. Fair dealing and other rights are in no way affected by the above. The parts used must not misrepresent the meaning of the publication. ILRI would appreciate being sent a copy of any materials in which text, photos etc. have been used.

Citation

BecA-ILRI Hub. *BecA-ILRI Hub 2016 Annual Report*. Nairobi, Kenya: Biosciences eastern and central Africa-International Livestock Research Institute Hub (BecA-ILRI) Hub.

ISBN: 92-9146-510-0

Production credits

Direction: Appolinaire Djikeng.

Writer/editor: Ethel Makila.

Editors: James Stapleton, Paul Karaimu.

Contributors—BecA-ILRI Hub: Clay Sneller, Francesca Stomeo, Frederick Ng'ang'a, Helen Altshul, Josephine Birungi, Josiah Mutuku, Julius Osaso, Nasser Yao, Philis Ochieng', Rachael Mwangi, Roger Pelle, Samuel Mutiga, Sita Ghimire, Tilly Eldridge, Valerian Aloo, Wellington Ekaya.

Contributors—Partners: Daniel Sila (JKUAT), Erik Bongcam-Rudloff (SLU), Jan Low (CIP), Jane Githinji (KALRO), Kathrin Heitz-Tokpa (Afrique One-ASPIRE), Kizito Nishimwe (University of Rwanda), Lusike Wasilwa (KALRO), Christian Keambou (University of Buea).

Design: Eric Ouma

Image credits

Cover, visiting scientist Victoria Tibenda from Aquaculture Research and Development Center, Uganda works at the BecA-ILRI Hub: BecA-ILRI Hub/Alnoor Abdulla

Inside front cover, vision page left and middle, 2, 15, 24, 25 top: BecA-ILRI Hub/Alnoor Abdulla

Vision page, 4, 9 inset, 16 left and top: BecA-ILRI Hub/Marvin Wasonga

Page 3 bottom, 4, 5, 11 main, 43 main and inset: BecA-ILRI Hub/Eunice Machuka

Page 7, 11, 14, 18 middle and lower right, 34, 37: BecA-ILRI Hub/Sylvia Muthoni

Page 8, 28, 45: BecA-ILRI Hub

Page 8 background, 9, 28, 50, 52, 54, 58: Shutterstock

Page 11 main: NCSU and Charles J. Sharp

Page 14 top, 22 inset: KALRO

Page 18 group, 44: ILRI/Apollo Habtamu

Page 21: University of Buea

Page 27: SLU

Page 28: BecA-ILRI Hub/Ethel Makila)

Page 29 inset: Ohio State University

Page 29: BecA-ILRI Hub/David White

Page 31: The World Food Prize

Page 32, 33: ILRI/Samuel Mungai

Page 38: University of Dschang/Félix Meutchieye

Page 39: University of Dschang/Mbuih Zukane

Page 41 bottom: Afrique One-ASPIRE

Page 49: Makerere University

Patron: Professor Peter C Doherty, AC, FAA, FRS

Box 30709, Nairobi 00100, Kenya

Phone: +254 20 422 3000/3903

Fax: +254 20 422 3001

ILRI-Kenya@cgiar.org

BecAdirector@cgiar.org

hub.africabiosciences.org

Animal scientist, Nobel Prize Laureate for Physiology or Medicine-1996

ilri.org

better lives through livestock

ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia

Phone: + 251 11 617 2000

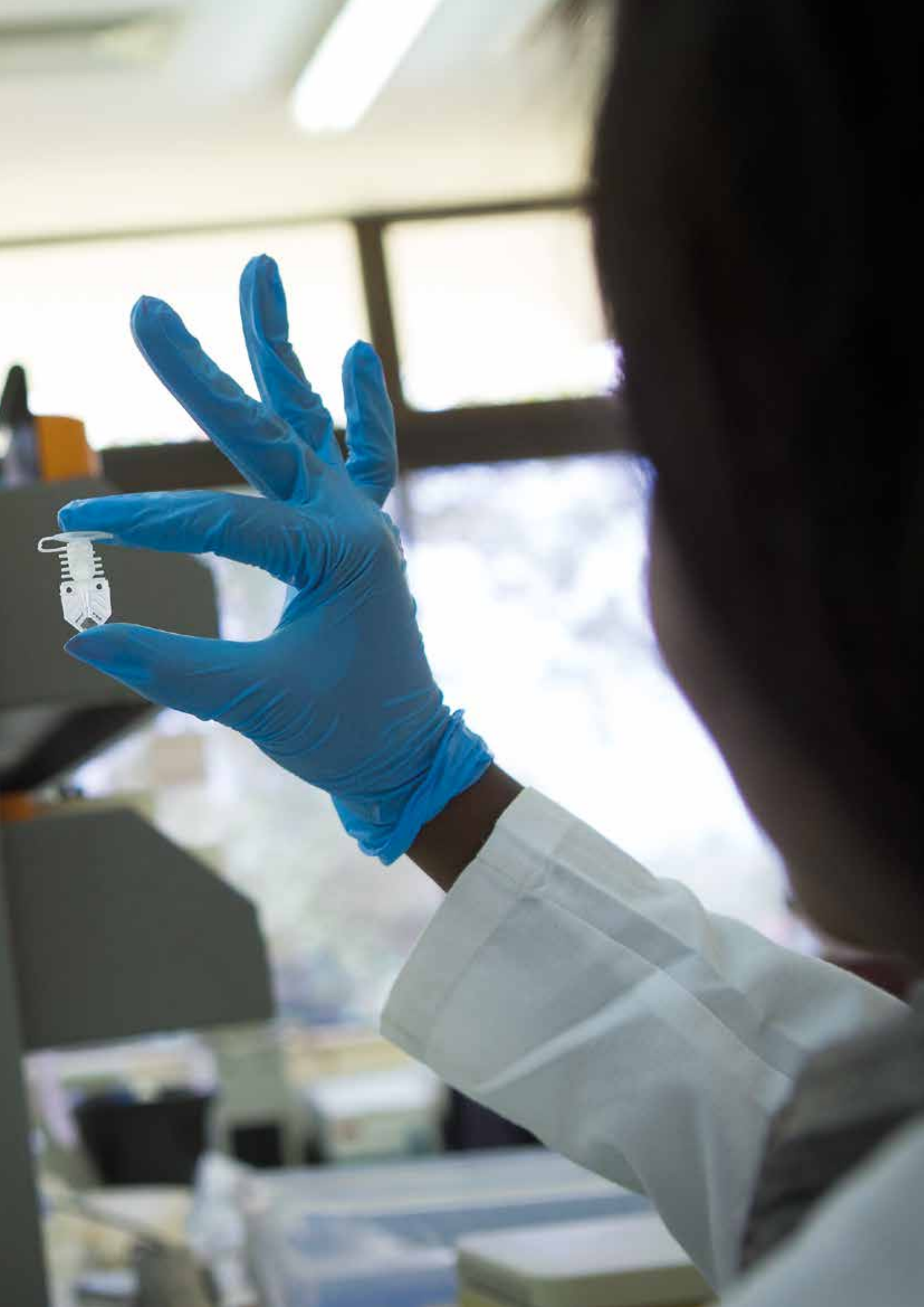
Fax: + 251 11 667 6923

Email: ILRI-Ethiopia@cgiar.org

ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa

The BecA-ILRI Hub remains committed to helping Africa use biosciences as a means of transforming agriculture, bridging the gap between population growth and agricultural productivity on the continent.







The Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) platform is a shared agricultural research and biosciences facility co-created by ILRI and the African Union's New Partnership for Africa's Development (NEPAD). It increases access to world-class laboratories for African and international scientists conducting research on African agricultural challenges. The BecA-ILRI Hub is a focal point for learning, interaction and strategic research towards delivering products to improve food and nutritional security in Africa. hub.africabiosciences.org

NEPAD Agency is the implementing agency of the African Union, facilitating and coordinating the development of continent-wide programmes and projects, mobilising resources and engaging the global community, regional economic communities and countries in transforming Africa. NEPAD Agency is contributing to Africa's Agenda 2063 goals, the continent's long-term development framework for socio-economic transformation. nepad.org

The International Livestock Research Institute (ILRI) works to improve food security and reduce poverty in developing countries through research for better and more sustainable use of livestock. ILRI is a CGIAR research centre, a global research partnership of 15 centres working with many partners for a food-secure future. It works through a network of regional and country offices and projects in East, South and Southeast Asia, Central, East, Southern and West Africa, and in Central America. ilri.org

CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources and ecosystem services. Its research is carried out by 15 CGIAR centres in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector. cgiar.org



ILRI thanks all donors that globally support its work through their contributions to the CGIAR system